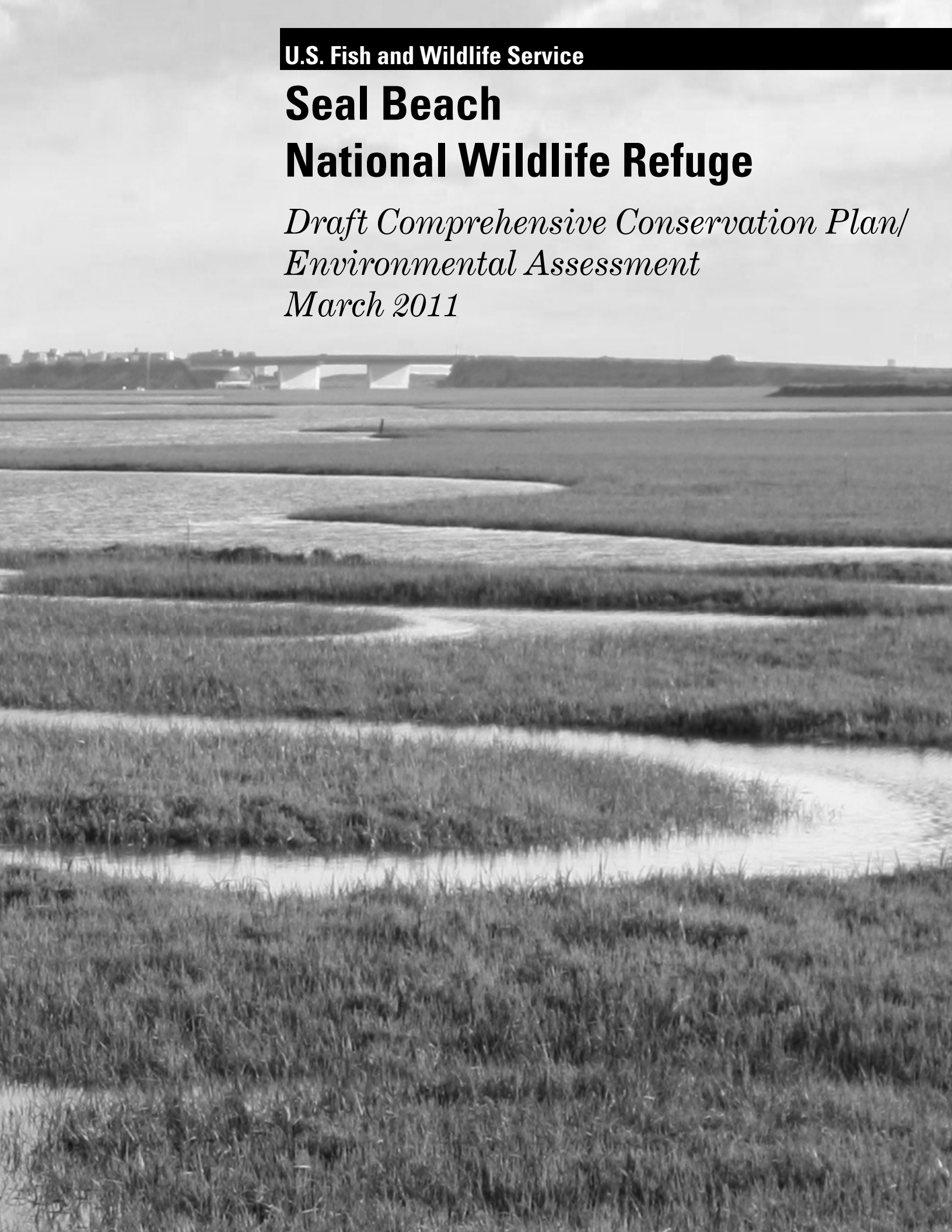
U.S. Fish and Wildlife Service

Seal Beach National Wildlife Refuge

Draft Comprehensive Conservation Plan/ Environmental Assessment

March 2011



Comprehensive Conservation Plans provide long-term guidance for management decisions and set forth goals, objectives, and strategies needed to accomplish refuge purposes and identify the Service's best estimate of future needs. These plans detail program planning levels that are sometimes substantially above current budget allocations and, as such, are primarily for Service strategic planning and program prioritization purposes. The plans do not constitute a commitment for staffing increases, operational and maintenance increases, or funding for future land acquisition.

U.S. Fish & Wildlife Service

Seal Beach National Wildlife Refuge

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Vision Statement

Tidal channels meandering through a sea of cordgrass deliver moisture and nourishment to support a healthy marsh ecosystem. As the quiet calm of the morning is interrupted by the clacking of a light-footed clapper rail, school children and other visitors, standing on the elevated observation deck, point with excitement in the direction of the call hoping for a glimpse of the rare bird. Shorebirds dart from one foraging area to another feasting on what appears to be an endless supply of food hidden within the tidal flats. California least terns fly above the tidal channels searching for small fish to carry back to their nests on NASA Island. A diverse array of marine organisms, from tube worms and sea stars to rays and sharks, and even an occasional green sea turtle, thrive within the tidal channels and open water areas of the Refuge's diverse marsh complex, while Nelson's sharp-tailed sparrows and other upland birds find food and shelter within the native upland vegetation that borders the marsh.

U. S. Fish and Wildlife Service
Pacific Southwest Region
2800 Cottage Way, Room W-1832
Sacramento, CA 95825-1846

March 2011

Seal Beach National Wildlife Refuge
Draft Comprehensive Conservation Plan/Environmental Assessment
Orange County, California

Type of Action:	Administrative
Lead Agency:	U.S. Department of the Interior, Fish and Wildlife Service
Responsible Official:	Ren Lohoefener, Regional Director, Pacific Southwest Region
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Abstract: This Draft Comprehensive Conservation Plan/Environmental Assessment (CCP/EA) describes and evaluates various alternatives for managing the Seal Beach National Wildlife Refuge (NWR). Three alternatives, including a No Action Alternative (Alternative A) as required by the National Environmental Policy Act (NEPA) regulations, are described, compared, and assessed for the Seal Beach NWR. The three alternatives are summarized below:

Alternative A – No Action: This alternative assumes no change from past management programs and serves as the baseline to which all other action alternatives are compared. There would be no major changes in habitat management or the current public use program under this alternative.

Alternative B – Maximize Salt Marsh Restoration, Continue Current Public Uses: Under this alternative, current wildlife and habitat management activities would be expanded to include evaluation of current baseline data for fish, wildlife, and plants on the Refuge, identification of data gaps, implementation of species surveys to address data gaps as staff time and funding allows, and support for new research projects that would benefit Refuge resources and Refuge management. Also proposed is the restoration of approximately 22 acres of intertidal habitat (salt marsh and intertidal mudflat) and 15 acres of wetland/upland transition habitat. Pest control would be implemented in accordance with an Integrated Pest Management (IPM) program and mosquito monitoring and control would be guided by a Mosquito Management Plan. No changes to the current public use program are proposed.

Alternative C (Proposed Action) – Optimize Upland/Wetland Restoration, Improve Opportunities for Wildlife Observation: The majority of the management activities, including the IPM program and Mosquito Management Plan, proposed in Alternative B would also be implemented under this Alternative. The primary difference between Alternatives B and C is that under Alternative C a larger portion of the areas to be restored would consist of upland and wetland/upland transition habitat. Approximately 12 acres of currently disturbed upland would be restored to native upland habitat, about 10 acres would be restored to wetland/upland transition habitat, and approximately 15 acres would be restored to intertidal habitat. In addition, Alternative C includes limited expansion of the current public use program, including expanded opportunities for wildlife observation.

The issues addressed in this Draft CCP/EA include the potential effects of the various alternatives on the physical environment, biological and cultural resources, and the social/economic environment. The adverse and beneficial effects of implementing the alternatives are generally described in the following action categories: habitat and wildlife management, pest management, and public use.

Providing Comments: Your comments on the Draft CCP/EA should be mailed, faxed, or emailed to the San Diego NWR Complex no later than **May 11, 2011**. Comments should be mailed to:

Victoria Touchstone
U.S. Fish and Wildlife Service
San Diego NWR Complex
6010 Hidden Valley Road, Suite 101
Carlsbad, CA 92011

Faxed comments should be directed to Victoria Touchstone at (760) 930-0256 and emailed comments should be directed to Victoria_Touchstone@fws.gov (please include "Seal Beach CCP" in the subject line).

Comments should be provided to the Service during the public review period of this Draft CCP/EA. This will enable us to analyze and respond to the comments at one time and to use this input in the preparation of the Final CCP. Comments should be specific and should address the document's adequacy and the merits of the alternatives described. Environmental objections that could have been raised at the draft stage may be waived if not raised until after the completion of the Finding of No Significant Impact (FONSI).

All comments received from the public will be placed in the Service's record for this action. As part of the record, comments will be made available for inspection by the general public, and copies may be provided to the public. For persons who do not wish to have their names and other identifying information made available, anonymous comments will be accepted.

Reader's Guide

The U.S. Fish and Wildlife Service will manage the Seal Beach National Wildlife Refuge (NWR) in accordance with an approved Comprehensive Conservation Plan (CCP). This CCP provides long range guidance on Refuge management through its vision, goals, objectives, and strategies. The CCP also provides a basis for a long-term adaptive management process including implementation, monitoring progress, evaluating and adjusting, and revising plans accordingly. Additional step-down planning will be required prior to implementation of certain programs and projects.

This document combines both a Draft Comprehensive Conservation Plan and Environmental Assessment (Draft CCP/EA). Following the completion of public review and evaluation of the comments received, the Service will identify the preferred alternative. Assuming no significant adverse effects are identified, the Service will also issue a Finding of No Significant Impact (FONSI). Once the FONSI is signed, the Final CCP will be prepared.

The following chapter and appendix descriptions are provided to assist readers in locating and understanding the various components of the CCP/EA.

Chapter 1, *Introduction,* includes the purpose of and need for the CCP and EA; an overview of the National Wildlife Refuge System; legal and policy guidance for planning for and managing the resources on National Wildlife Refuges; setting, regional context, and history of the Seal Beach NWR; and Refuge purposes, vision, and goals for future management.

Chapter 2, *The Planning Process*, describes the CCP planning process, including the public involvement aspects of the process. This chapter also provides background on major planning issues identified by Refuge staff, Federal, Tribal, State, and local agencies, and/or the public, as well as a variety of management concerns and opportunities.

Chapter 3, *Alternatives*, describes three management alternatives proposed for the Refuge. Each alternative represents a different approach to achieving the vision, goals, and objectives for the Refuge. Alternative A (No Action) describes current management practices. Alternative C is the proposed action.

Chapter 4, *Affected Environment*, describes the existing physical and biological environment, public uses, cultural resources, and socioeconomic conditions. They represent baseline conditions for the comparisons made in Chapter 5.

Chapter 5, *Environmental Consequences*, describes the potential impacts of each of the alternatives on the resources, programs, and conditions outlined in Chapter 4.

Chapter 6, *Implementation*, presents the details of how the proposed action (Alternative C) for the Seal Beach NWR would be implemented if it is selected as the preferred alternative when the Final CCP is approved, including details regarding the objectives and strategies necessary to achieve the Refuge goals. This chapter also addresses step-down planning, adaptive management, compliance requirements, and Refuge operations, including funding and staffing proposals.

Chapter 7, *Reference Cited,* provides bibliographic references for the citations in this document.

Appendix A, *Compatibility Determinations (draft),* describe uses, anticipated impacts, stipulations, and a determination of compatibility for wildlife observation, interpretation, and environmental education, as well as scientific research and mosquito management. The latter two uses also include a determination of appropriate use.

Appendix B, *List of Preparers, Planning Team Members, and Persons/Agencies Consulted,* lists those individuals involved in the preparation of the CCP/EA, as well as those agencies consulted during the preparation of this planning document.

Appendix C, *Integrated Pest Management Program (draft)*, is a step-down management plan that provides guidance for managing pests on the Refuge, including invasive plant species control. This program does not address the control of mosquitoes.

Appendix D, *Mosquito Management Plan (draft)*, is a step-down management plan that presents a phased approach to mosquito management, including monitoring and control, on the Refuge.

Appendix E, *Federal and State Ambient Air Quality Standards,* presents the currently adopted Federal and State Ambient Air Quality Standards.

Appendix F, *Species Lists*, contains a list of the bird species observed on the Refuge, as well as additional lists for mammalian, plant, and reptile species that have been observed on the Refuge.

Appendix G, *Fire Management Plan Exemption,* documents that the Seal Beach NWR has been exempted from the requirement to prepare a fire management plan.

Appendix N, *Wilderness Inventory,* outlines the process used to determine that the Seal Beach NWR does not meet the criteria for a wilderness review or designation.

Appendix I, *Request for Cultural Resource Compliance Form,* is an example of the form that must be submitted to initiate cultural resource review.

Appendix J, *Glossary of Terms*, contains acronyms, abbreviations, and definitions of terms used in this document.

Appendix K, *Distribution List*, contains the list of Federal, Tribal, State, and local agencies, nongovernmental organizations, libraries, and individuals who received notification of the availability of the Draft CCP/EA and other planning updates associated with this planning effort.

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1 Introduction

1.1 Introduction

Seal Beach National Wildlife Refuge (NWR or Refuge) encompasses approximately 965 acres of coastal wetlands and uplands in northwestern Orange County, California (see Figure 1-1). The Refuge, which is managed by the U.S. Fish and Wildlife Service (Service) as part of the National Wildlife Refuge System (NWRS), is located entirely within the boundaries of Naval Weapons Station Seal Beach (NWSSB) (Figure 1-2). The tidally influenced wetland habitat protected within the Refuge supports thousands of migratory birds that travel along the Pacific Flyway and provides habitat for listed species including the California least tern (*Sternula antillarum browni*) and light-footed clapper rail (*Rallus longirostris levipes*), both of which nest on the Refuge.

This Comprehensive Conservation Plan (CCP) has been prepared to describe the desired future conditions of the Seal Beach NWR. It is also intended to provide long-range guidance and management direction to achieve the purposes for which the Refuge was established; to help fulfill the mission of the National Wildlife Refuge System; to maintain and, where appropriate, restore the ecological integrity of the Refuge and the Refuge System; and to meet other mandates.

1.2 Purpose and Need for the Plan

The purpose and need for the Seal Beach NWR CCP is to provide guidance to the Refuge Manager and others for how this Refuge should be managed to best achieve the purposes for which it was established and to contribute to the mission of the NWRS. The CCP when completed is intended to provide a 15-year management plan for addressing the conservation of fish, wildlife, and plant resources and their related habitats, while also presenting the opportunities on the Refuge for compatible wildlife-dependent recreational uses. It is through the CCP process that the overarching wildlife, public use, and/or management needs for the Refuge, as well as any issues affecting the management of Refuge resources and public use programs, are identified; and various strategies for meeting Refuge needs and/or resolving issues that may be impeding the achievement of Refuge purposes are evaluated and ultimately presented for implementation.

The CCP is intended to:

- Ensure that Refuge management is consistent with the NWRS mission and Refuge purposes and that the needs of wildlife come first, before other uses;
- Provide a scientific foundation for Refuge management;
- Establish a clear vision statement of the desired future conditions for Refuge habitat, wildlife, other species, visitor services, staffing, and facilities;
- Communicate the Service's management priorities for the Refuge to its neighbors, visitors, partners, state, local, and other Federal agencies, and to the general public;
- Ensure that current and future uses of the Refuge are compatible with Refuge purposes;
- Provide long-term continuity in Refuge management; and
- Provide a basis for budget requests to support the Refuge's needs for staffing, operations, maintenance, and capital improvements.

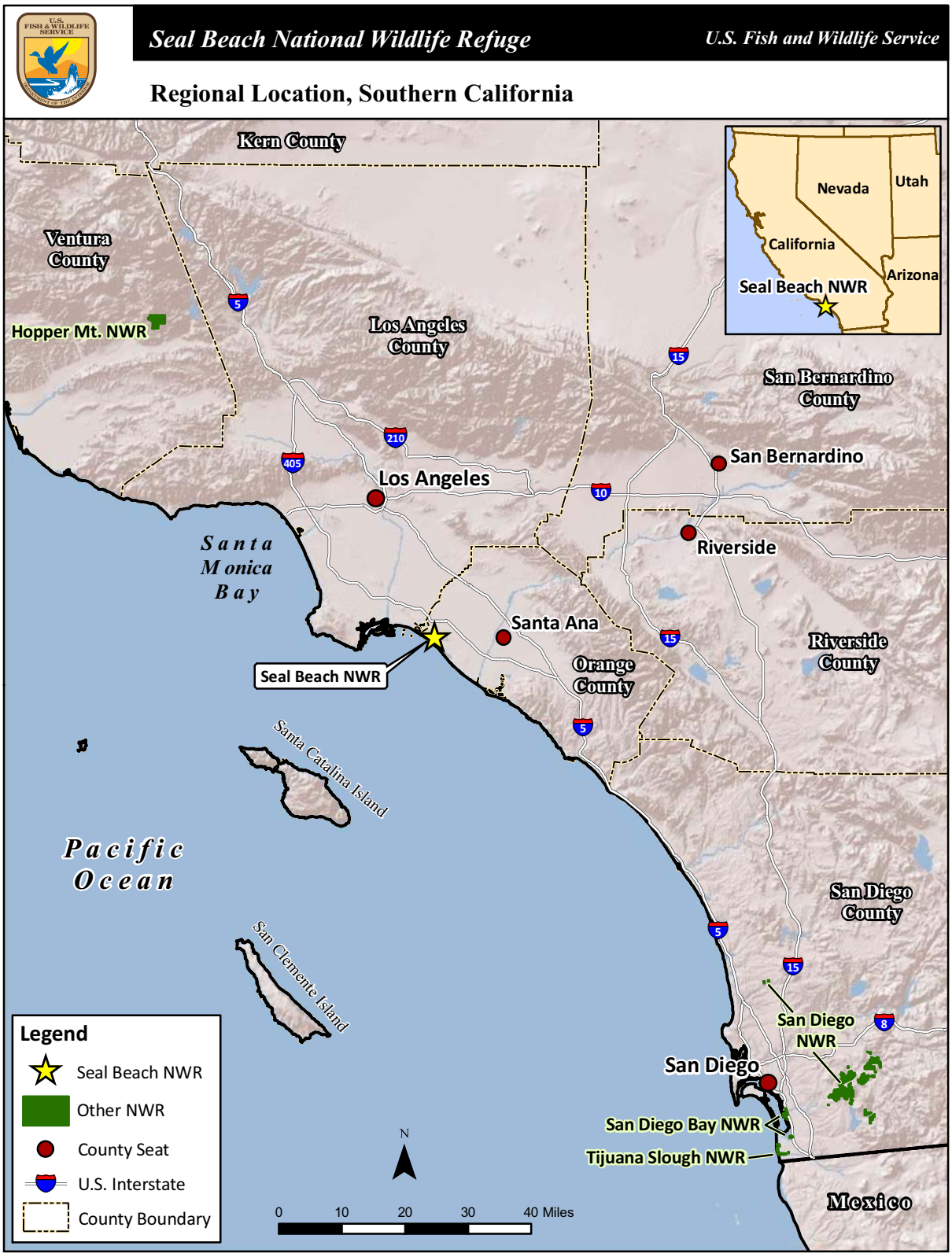

Figure 1-1. Regional Vicinity Map for the Seal Beach National Wildlife Refuge

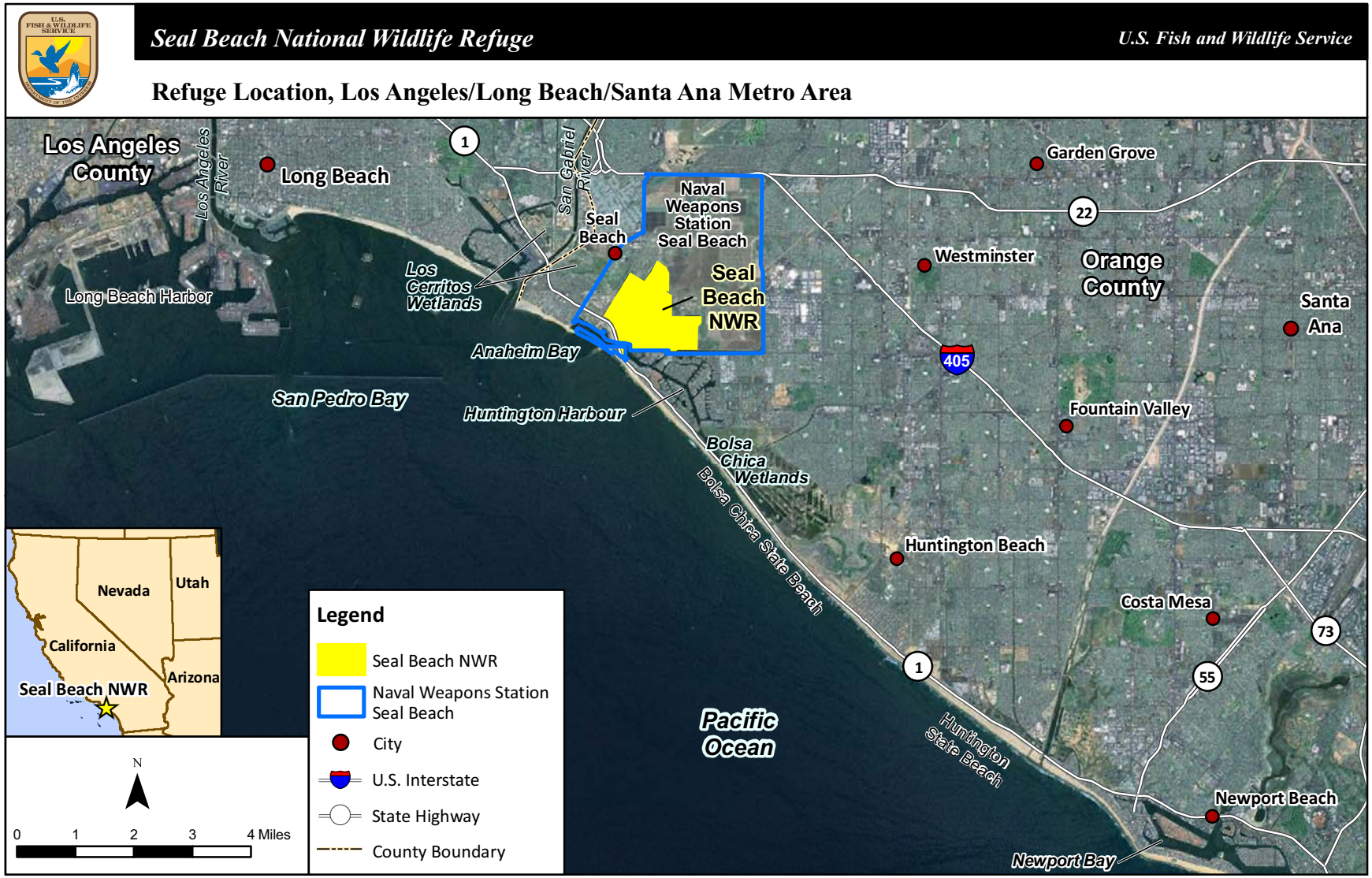

Figure 1-2. Location Map

The development of this CCP is also required to fulfill legislative obligations of the Service. Its preparation is mandated by the National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997 (the Improvement Act) (Public Law 105-57). The Improvement Act requires that a CCP be prepared for each refuge or related complex of refuges within 15 years of the law's enactment. In accordance with the Act, the Service is developing a CCP for each refuge included within the NWRS.

Currently, the plans available to direct management on the Seal Beach NWR are limited to: the *General Plan for Use of U.S. Navy Lands and Waters for Wildlife Conservation and Management,* approved in 1973; *Management Plan for the Seal Beach NWR*, approved in 1974; and the *Endangered Species Management and Protection Plan*, approved in 1991. Although general direction is provided in these plans, there is no overarching management plan in place that describes the future strategies that should be implemented to address current and future changes in Refuge conditions, such as sea level rise, or for achieving Refuge purposes. The CCP will provide the first comprehensive management plan for the Refuge.

Once approved, the CCP will set forth Refuge goals and objectives, which are based on specific Refuge purposes, Federal laws, NWRS goals, and Service policies, and will describe the strategies to be implemented to achieve these goals and objectives. The CCP addresses all activities that will occur on the Refuge; however, the noted management activities or strategies may be broadly stated. In such cases, the Refuge staff will prepare detailed step-down plans to describe how a management strategy, such as habitat restoration, will be implemented. As such, these step-down plans provide specific strategies and implementation schedules for meeting the various goals and objectives identified in the CCP. The step-down plans to be developed for the Seal Beach NWR following CCP approval are described in Chapter 6.

1.3 U.S. Fish and Wildlife Service and National Wildlife Refuge System

1.3.1 U.S. Fish and Wildlife Service

The Service is the primary Federal agency responsible for conserving and enhancing the nation's fish and wildlife populations and their habitats. Although this responsibility is shared with other Federal, State, Tribal, local, and private entities, it is the Service that has specific responsibilities for migratory birds, threatened and endangered species, interjurisdictional fish, and certain marine mammals. The Service also has similar trust responsibilities for the lands and waters it administers to support the conservation and enhancement of fish and wildlife.

1.3.2 National Wildlife Refuge System

The NWRS is the largest system of lands and waters in the world specifically dedicated to the conservation of fish and wildlife. Operated and managed by the Service, the NWRS currently includes more than 150 million acres, consisting of 553 national wildlife refuges and other units of the Refuge System and 37 wetland management districts. The majority of refuge lands (over 77 million acres) are in Alaska. The remaining acreage is scattered across the other 49 states and several island territories. About 21 million acres are managed as wilderness under the Wilderness Act of 1964.

The NWRS started in 1903, when President Theodore Roosevelt established Pelican Island as the nation's first bird sanctuary. With this action, pelicans, herons, ibis, and roseate spoonbills nesting on a small island in Florida's Indian River were given protection from feather collectors who were decimating their colonies. President Roosevelt went on to establish many other sanctuaries for

wildlife during his tenure. This small network of sanctuaries continued to expand, later becoming the NWRS. In contrast to other public lands, which are managed under a multiple-uses mandate (e.g., National Forests managed by the U.S. Forest Service, and lands administered by the U.S. Bureau of Land Management), the lands within the NWRS are managed primarily for the benefit of fish, wildlife, and plant resources and their habitats.

The mission of the NWR 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 Improvement Act).

The administration, management, and growth of the NWRS are guided by the following goals *(Fish and Wildlife Service Manual, Part 601 FW1, NWRS Mission and Goal, and Refuge Purposes)*:

- Conserve a diversity of fish, wildlife, and plants and their habitats, including species that are endangered or threatened with becoming endangered.
- Develop and maintain a network of habitats for migratory birds, anadromous and interjurisdictional fish, and marine mammal populations that is strategically distributed and carefully managed to meet important life history needs of these species across their ranges.
- Conserve those ecosystems, plant communities, wetlands of national or international significance, and landscapes and seascapes that are unique, rare, declining, or underrepresented in existing protection efforts.
- Provide and enhance opportunities to participate in compatible wildlife-dependent recreation (hunting, fishing, wildlife observation and photography, and environmental education and interpretation).
- Foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife, and plants and their habitats.

1.4 Legal and Policy Guidance

Legal mandates and Service policies govern the Service's planning and management of the NWRS. A list and brief description can be found at the "Division of Congressional and Legislative Affairs, USFWS" Web site (http://www.fws.gov/laws/Lawsdigest.html). In addition, the Service has developed policies to guide NWRS planning and management. These policies can be found at the "NWRS Policies Web site" (http://www.fws.gov/refuges/policiesandbudget/refugepolicies.html). The main sources of legal and policy guidance for the CCP and EA are described below.

1.4.1 National Wildlife Refuge System Improvement Act of 1997

Statutory authority for Service management and associated habitat management planning on units of the NWRS is derived from the National Wildlife Refuge System Administration Act of 1966 (Refuge Administration Act), which was significantly amended by the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act, 16 U.S.C. 668dd-668ee). Section 4(a)(3) of the Improvement Act states, "With respect to the National Wildlife Refuge System, it is the policy of the United States that – (A) each refuge shall be managed to fulfill the mission of the System, as well as the specific purposes for which that refuge was established . . ." The Improvement Act also states that the, "purposes of the refuge and purposes for each refuge mean the purposes specified in or derived from law, proclamation, executive order, agreement, public land order, donation

document, or administrative memorandum establishing, authorizing , or expanding a refuge, refuge unit, or refuge subunit."

The Refuge Administration Act, as amended, clearly establishes wildlife conservation as the core NWRS mission. House Report 105-106, accompanying the Improvement Act, states that "the fundamental mission of our Refuge System is wildlife conservation: wildlife and wildlife conservation must come first." In contrast to other systems of public lands, which are managed on the sustained–yield basis for multiple uses, the NWRS is a primary-use network of lands and waters. First and foremost, refuges are managed for fish and wildlife, plants and their habitats. In addition, units of the NWRS are legally closed to all public access and use, including economic uses, unless and until they are officially opened through an analytical, public process called the refuge compatibility process. With the exception of refuge management activities, which are not economic in nature, all other uses are subservient to the NWRS' primary wildlife management responsibility and they must be determined compatible before being authorized.

The Improvement Act provides clear standards for management, use, planning, and growth of the NWRS. Its passage followed the promulgation of Executive Order 12996 (April 1996), "Management of Public Uses on National Wildlife Refuges," reflecting the importance of conserving natural resource for the benefit of present and future generations of people. The Improvement Act recognizes that wildlife-dependent recreational uses involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation, when determined to be compatible with the mission of the NWRS and purposes of the Refuge, are legitimate and appropriate public uses of the Refuge System.

Section 5 of the Improvement Act directs the Secretary of the Interior to ensure or conduct 14 actions in administering the NWRS. In addressing these actions, a number of policies have been developed to help guide the administration of Refuge lands. These policies are summarized below.

Compatibility Policy

The Improvement Act states "the Secretary shall not initiate or permit a new use of a Refuge or expand, renew, or extend an existing use of a Refuge, unless the Secretary has determined that the use is a compatible use and that the use is not inconsistent with public safety." The Improvement Act also states that "compatible wildlife-dependent recreational uses [hunting, fishing, wildlife observation and photography, or environmental education and interpretation] are the priority general public uses of the System and shall receive priority consideration in Refuge planning and management; and when the Secretary determines that a proposed wildlife–dependent recreational use is a compatible use within a refuge, that activity should be facilitated, subject to such restrictions or regulations as may be necessary, reasonable, and appropriate."

In accordance with the Improvement Act, the Service has adopted a Compatibility Policy (*Fish and Wildlife Service Manual, Part 603 FW 2*) that includes guidelines for determining if a use proposed on a NWR is compatible with the purposes for which the refuge was established. A compatible use is defined in the policy as a proposed or existing wildlife-dependent recreational use or any other use of a NWR that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the NWRS mission or the purposes for which the Refuge was established. The Policy also includes procedures for documentation and periodic review of existing refuge uses.

When a determination is made as to whether a proposed use is compatible or not, this determination is provided in writing and is referred to as a compatibility determination. An

opportunity for public review and comment is required for all compatibility determinations. Compatibility determinations prepared concurrently with a CCP are included in the public review process for the draft CCP and associated NEPA document. The Refuge has completed draft compatibility determinations for wildlife observation, interpretation and environmental education, as well as mosquito control and research. These compatibility determinations are available for review and comment in Appendix A.

Appropriate Use Policy

Refuges are first and foremost national treasures for the conservation of wildlife. Through careful planning, consistent system-wide application of regulations and policies, diligent monitoring of the impacts of uses on wildlife resources, and preventing or eliminating uses not appropriate to the Refuge System, the conservation mission of the Refuge System can be achieved, while also providing the public with lasting opportunities to enjoy and appreciate the resources protected within the Refuge System. The Appropriate Use Policy (*Fish and Wildlife Service Manual, Part 603 FW* 1) provides a national framework for determining appropriate refuge uses and outlines the procedures refuge managers must follow when deciding if a new or existing use is an appropriate use on the refuge. If an existing use is not appropriate, the refuge manager will eliminate or modify the use as expeditiously as practicable. If a proposed use is not determined to be appropriate, the use will not be allowed and a compatibility determination will not be prepared.

To be considered appropriate, a proposed or existing use on a refuge must meet at least one of the four conditions described below. All uses determined to be appropriate are also reviewed for compatibility.

1) The use is a wildlife-dependent recreational use as identified in the Improvement Act (i.e., hunting, fishing, wildlife observation and photography, and environmental education and interpretation).
2) The use contributes to fulfilling the refuge purpose(s), the Refuge System mission, or goals or objectives described in a refuge management plan approved after October 9, 1997.
3) The use involves the take of fish and wildlife under State regulations. (States have regulations concerning take of wildlife that includes hunting, fishing, and trapping. Take of wildlife under such regulations is considered appropriate; however, the refuge manager must determine if the activity is compatible before allowing it on a refuge.)
4) The use has been found to be appropriate after considering the following criteria:
   a) The Service has jurisdiction over the use. (If the Service does not have jurisdiction over the use or the area where the use would occur, no authority exists to consider the use.)
   b) The use complies with all applicable laws and regulations (e.g., Federal, State, tribal, and local). (Uses prohibited by law are not appropriate.)
   c) The use is consistent with applicable Executive Orders and Department and Service policies. (If a use conflicts with an applicable Executive Order or Department or Service policy, the use is not appropriate.)
   d) The use is consistent with public safety. (If a use creates an unreasonable level of risk to visitors or refuge staff, or if the use requires refuge staff to take unusual safety precautions to assure the safety of the public or other refuge staff, the use is not appropriate.)

e) The use is consistent with refuge goals and objectives in an approved management plan or other document. (If a use, either itself or in combination with other uses or activities, conflicts with a refuge goal, objective, or management strategy, the use is generally not appropriate.)

f) The use has been previously considered in a refuge planning process or under this policy and was rejected as not appropriate. (Unless circumstances or conditions have changed significantly, the use need not be considered further.)

g) The use would not divert management efforts or resources away from the proper and reasonable management of a refuge or the implementation of a wildlife-dependent recreational use. (A use, other than a wildlife-dependent recreational uses [i.e., hunting, fishing, wildlife observation and photography, and environmental education and interpretation], that diverts available resources is generally not appropriate.)

h) The use will be manageable in the future within existing resources. (If a use would lead to recurring requests for the same or similar activities that will be difficult to manage in the future, then the use is not appropriate. However, if the use can be managed so that impacts to natural and cultural resources are minimal or inconsequential, or if clearly defined limits can be established, then the use may be further considered.)

i) The use contributes to the public's understanding and appreciation of the refuge's natural or cultural resources, or is beneficial to the refuge's natural or cultural resources. (If this is not the case, such a use would generally be considered not appropriate.)

j) The use can be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality, compatible, wildlife-dependent recreation into the future. (If this is not the case, such a use would generally be considered not appropriate.)

This Policy also states that if, during preparation of the CCP, a previously approved use can no longer be considered appropriate on the refuge, the reasons for this determination must be clearly explained to the public and a description of how the use will be eliminated or modified must also be provided. The documentation for both appropriateness findings and compatibility determinations are provided in Appendix A.

Although a refuge use may be both appropriate and compatible, the refuge manager retains the authority to not allow the use or to modify the use. For example, on some occasions, two appropriate and compatible uses may be in conflict with each other. In these situations, even though both uses are appropriate and compatible, the refuge manager may need to limit or entirely curtail one of the uses in order to provide the greatest benefit to refuge resources and the public.

Biological Integrity, Diversity and Environmental Health Policy

Section 4(a)(4)(B) of the Improvement Act states, "In administering the System, the Secretary shall . . . ensure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans . . ." This legislative mandate represents an additional directive to be followed while achieving refuge purposes and the NWRS mission. The Improvement Act requires the consideration and protection of a broad spectrum of fish, wildlife, plant and habitat resources found on a refuge. To implement this mandate, the Service has issued the Biological Integrity, Diversity and Environmental Health Policy (*Fish and Wildlife Service Manual, Part ,601 FW 3*), which provides policy for maintaining and restoring, where appropriate, the biological integrity,

diversity, and environmental health of the NWRS. This policy provides a refuge manager with an evaluation process to analyze his/her refuge and recommend the best management direction to prevent further degradation of environmental conditions; and where appropriate, and in concert with refuge purposes and the NWRS mission, to restore lost or severely degraded resource components. Within section 3[3.7B] of the policy, the relationships among biological integrity, diversity, and environmental health; the NWRS mission; and refuge purposes are explained as follows, "…each refuge will be managed to fulfill refuge purpose(s) as well as to help fulfill the System mission, and we will accomplish these purposes(s) and our mission by ensuring that the biological integrity, diversity, and environmental health of each refuge are maintained and where appropriate, restored."

When evaluating the appropriate management direction for refuges, refuge managers will use sound professional judgment to determine their refuge's contribution to biological integrity, diversity, and environmental health at multiple landscape scales. Sound professional judgment incorporates field experience, an understanding of the refuge's role within an ecosystem, and the knowledge of refuge resources, applicable laws, and best available science, including consultation with resource experts both inside and outside of the Service.

The priority public uses of the NWRS are not in conflict with this policy when they have been determined to be compatible. The directives of this policy do not envision or necessitate the exclusion of visitors or the elimination of visitor use structures from refuges; however, maintenance and/or restoration of biological integrity, diversity, and environmental health may require spatial or temporal zoning of visitor use programs and associated infrastructures. General success in maintaining or restoring biological integrity, diversity, and environmental health will produce higher quality opportunities for wildlife-dependent recreational uses.

Wilderness Stewardship Policy

The Wilderness Stewardship Policy, described in Part 610 FW 1 – 5 of the Fish and Wildlife Service Manual, provides an overview and foundation for implementing the National Wildlife Refuge System Administration Act of 1966, as amended, and the Wilderness Act of 1964. In the Wilderness Act, Congress called for the establishment of a National Wilderness Preservation System to secure an "enduring resource of wilderness" for the American public. Wilderness, as defined in Section 2(c) of the Wilderness Act, is an area that ". . . generally appears to have been affected primarily by the forces of nature with the imprint of man's work sustainably unnoticeable . . . has outstanding opportunities for solitude or a primitive and unconfined type of recreation . . . [and] has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition…"

The Wilderness Stewardship Policy provides refuge managers with guidance on conducting wilderness reviews on Refuge System lands to determine if these lands should be recommended for wilderness designation. It also establishes policy for managing wilderness study areas and recommended and proposed wilderness. The Policy also prescribes how refuge managers will preserve the character and qualities of designated wilderness while managing for refuge establishing purpose(s).

Part 610 FW 4 of the Service Manual describes the wilderness review process, a process that must be followed when identifying and recommending for congressional designation Refuge System lands and waters that merit inclusion in the National Wilderness Preservation System. Wilderness reviews are to be conducted as part of a scheduled CCP or CCP revision, but can also be conducted at any time if significant new information becomes available, ecological conditions change (including the restoration of significant acreage to natural conditions so that

area now meets the definition of wilderness), or major refuge expansion occurs. The process must include interagency and tribal coordination, public involvement, and National Environmental Policy Act (NEPA) compliance. The wilderness review conducted for the Seal Beach NWR as part of the CCP process is described in Chapter 6, Implementation.

1.4.2 National Environmental Policy Act of 1969

As the basic national charter for the protection of the environment, the National Environmental Policy Act (NEPA) requires Federal agencies to consider the environmental effects of all actions (i.e., policies, plans, programs, or projects that are implemented, funded, permitted, or controlled by a Federal agency or agencies) they undertake. Agencies must also consider the environmental effects of all reasonable and feasible alternatives to a proposed action, and must make public the environmental effects of the proposed action and possible alternatives. If adverse environmental effects cannot be entirely avoided, NEPA requires an agency to show evidence of its efforts to reduce these adverse effects and to restore and enhance environmental quality as much as possible. The contents of an environmental assessment (EA) or Environmental Impact Statement (EIS) document that an agency has addressed all of these issues.

Each CCP process must comply with the provisions of NEPA through the concurrent preparation of an EA or EIS that can accompany or be integrated into the draft CCP. The Seal Beach NWR CCP has been prepared consistent with the requirements of NEPA, the Council on Environmental Quality (CEQ) NEPA regulations (40 CFR §1500 et seq.), and the Department of Interior's NEPA procedures (Department Manual, Part 516). To comply with CEQ NEPA regulations and ensure the NEPA process to be integrated into the CCP process at the earliest possible time, an EA has been integrated directly into the draft CCP document for the Seal Beach NWR. In this document, the primary components of the EA (Section 1508.9 of the CEQ NEPA regulations) include Chapter 1, which addresses the purpose and need for the proposed action; Chapter 3 which presents the proposed action and the alternatives to the proposed action; Chapter 4, which describes the affected environment; Chapter 5, which presents the environmental consequences of the proposed action and the alternatives; and Appendix B, which lists the agencies and persons consulted.

1.5 Seal Beach National Wildlife Refuge

1.5.1 Location

The 965-acre Seal Beach NWR, which is included entirely within NWSSB, is located in the northwest corner of Orange County between the City of Seal Beach to the northwest and the City of Huntington Beach to the southeast (refer to Figures 1-1 and 1-2). The Refuge is situated in an area that is generally bordered to the southwest by Pacific Coast Highway, to the west by Seal Beach Boulevard, to the north by Westminster Avenue, and to the east and southeast by the Bolsa Chica flood control channel. The habitats within the Refuge are buffered from surrounding urban development on the north, east, and west by NWSSB, while the boating and residential development associated with Sunset Harbour Marina and the community of Huntington Harbour occur immediately to the south of the Refuge's coastal salt marsh habitat (refer to Figure 1-2).

1.5.2 Physical Setting

Located along the coast of southern California, Seal Beach NWR protects a remnant of what was once a vast wetland complex extending inland along the southern California bight from the Los Angeles and San Gabriel Rivers to the Santa Ana River. Marine and terrestrial wildlife thrived in the San Pedro, Los Alamitos, Anaheim, Bolsa, and Newport Bay estuaries. The Refuge protects all of what remains of Anaheim Bay's historical intertidal salt marsh complex (approximately 750

acres). These coastal wetlands are characterized by long tidal channels that transport ocean waters deep into the salt marsh habitat; tidal flats that are exposed during low tides; and large expanses of cordgrass-dominated salt marsh habitat. Another 116 acres of the Refuge support restored subtidal and intertidal ponds constructed in the early 1990s as part of a Port of Long Beach mitigation project. The remaining lands within the Refuge include several upland areas, some natural and some filled in the past to support military activities, as well as an area of muted salt marsh habitat.

The Seal Beach NWR is an important stopover and wintering location within the Pacific Flyway, providing relatively undisturbed habitat for thousands of migratory birds including shorebirds, waterfowl, and raptors. The Refuge supports several Federally and/or state listed endangered or threatened avian species, including the California least tern, light-footed clapper rail, and Belding's savannah sparrow (*Passerculus sandwichensis beldingi*), all of which nest and raise their young on the Refuge. The Federally listed endangered eastern Pacific green turtle (*Chelonia mydas)* has also been observed within the Refuge.

1.5.3 Ecosystem Context

To the extent possible, the CCP will assist in meeting conservation goals established in existing national and regional plans, California's Wildlife Action Plan, and other landscape-scale plans covering the same watershed or ecosystem in which the Refuge resides (602 FW 3.3). With respect to landscape-scale planning, the Seal Beach NWR is included within the California Geographic Area, one of 21 Geographic Areas that were developed by aggregating Bird Conservation Regions (BCRs), biologically based units representing long-standing partnerships that facilitate conservation planning and design at landscape scales. Seal Beach NWR is included within the California Landscape Conservation Cooperative (LCC). LCCs are applied conservation science partnerships between the Service and other federal agencies, states, tribes, non-governmental organizations (NGOs), universities and stakeholders within a geographically defined area. The LCCs will do work that will inform resource management decisions and actions to address landscape-scale stressors, such as habitat fragmentation, genetic isolation, invasive species, and water scarcity, all of which are accelerated by climate change. LCCs will reflect the principles and practices of adaptive management in all of their activities, especially in developing conservation strategies, evaluating their effectiveness, and revising them. This iterative process of information sharing will help scientists and resource managers deal with uncertainties on the landscape and provide tools to compare and contrast the implications of management alternatives.

The California Geographic Area will be divided into several subunits. Seal Beach NWR will be included within the Coastal Southern Subunit, which covers the coastal mountain ranges of central California, southern California and northern Mexico, lands between the Mojave Desert and the Pacific Ocean, and numerous offshore islands. Like other LCCs, the California LCC will provide a forum for information exchange and feedback among partners and, secondarily, among other interested parties (e.g., organizations, scientists, and managers). In addition, LCC partners will jointly decide on the highest priority needs and interests of the LCC and will have a role in helping partners identify common goals and priorities.

Also from an ecosystem context, the Seal Beach NWR provides essential foraging and resting habitat for migratory birds traveling along the Pacific Flyway during migration, and protects Essential Fish Habitat for various fish species managed under the Pacific Groundfish and Coastal Pelagic Species Fishery Management Plans. The Refuge, which is located between the Los Cerritos wetland complex to the north (partially in Los Angeles County) and the Bolsa Chica wetlands to the south, is one of only seven remaining wetland complexes along the Orange County coast (refer to Section 4.1 for additional details).

Additional ecosystem planning efforts that address the resources managed within the Seal Beach NWR are described below. Regional plans that address resource management at the local level are described in greater detail in Chapter 4.

Sonoran Joint Venture Bi-national Bird Conservation

The Sonoran Joint Venture is a partnership of diverse organizations and individuals from the southwestern United States and northwestern Mexico that share a common commitment to bird conservation within the region. The Strategic Plan for the Sonoran Joint Venture presents a regional strategy to protect, conserve, restore, and enhance bird populations and their habitats. The strategic plan and the joint venture's actions in general are intended to address and integrate the conservation recommendations of the North American Waterfowl Management Plan, the Partners in Flight North American Landbird Conservation Plan, the U.S. Shorebird Conservation Plan, and North American Waterbird Conservation Plan for the areas included within this joint venture. For more information about these bird conservation plans, refer to Chapter 4.

Seal Beach NWR is located within the Californian Coast and Mountains Region of the Sonoran Joint Venture Bird Conservation Plan. Orange County coastal wetlands, which include Anaheim Bay, are identified in the plan as a focus area (e.g., locations that have been identified as having significant bird populations and habitat values, and/or the potential to be restored to a condition that supports bird populations). The primary conservation needs identified in the plan for the coastal wetland areas in this region are the protection of the remaining coastal wetland habitat, including eelgrass beds; the protection of existing avian nesting colonies, the development of education programs; and the promotion of sustainable fisheries (*Sonoran Joint Venture Technical Committee 2006*).

California Wildlife Action Plan

Seal Beach NWR is located within California's South Coast Region as designated by the California Wildlife Action Plan (*California Department of Fish and Game 2007*). The Plan's conservation actions that apply to the management of the Seal Beach NWR include protecting and restoring coastal wetlands; eradicating or controlling invasive species; considering effects to resources related to global warming; promoting wildlife and natural resources conservation education; and protecting sensitive species and important wildlife habitats on Federal lands.

Watershed Management

The Refuge is also included within the planning area for the North Orange County Integrated Regional Watershed Management Plan (*Orange County 2009*). This plan addresses water management objectives for the watershed, as well as recommends strategies for achieving these objectives. The plan also addresses issues related to water supply, water quality, flood control, ecosystem restoration, and climate change. An important component of plan implementation is obtaining funding for projects that will benefit water and habitat quality throughout the watershed, as well as achieve other watershed objectives.

1.5.4 Refuge Purpose and Authority

Legislation authorizing the establishment of the Seal Beach NWR was signed by President Richard M. Nixon on August 29, 1972. Public Law 92-408 (86 Stat. 633) states "The Refuge shall consist of certain lands, to be determined by the Secretary of the Interior with the advice and consent of the Secretary of the Navy, within the United States Naval Weapons Station, Seal Beach, California." It goes on to state that "The Secretary of the Interior shall administer the refuge in accordance with the National Wildlife Refuge System Administration Act of 1966,

as amended (80 Stat. 927; 16 U.S.C. 668dd – 668ee), and pursuant to the plans which are mutually acceptable to the Secretary of the Interior and the Secretary of the Navy."

Following the approval of the *General Plan for Use of U.S. Navy Lands and Waters for Wildlife Conservation and Management* by the Secretary of the Navy and the Secretary of the Interior in 1973, and the approval of a subsequent Management Plan by the Commanding Officer of Naval Weapons Station Seal Beach (NWSSB) and Service's Regional Director in May 1974, the Refuge was officially established on July 11, 1974 when the Notice of Establishment was published in the *Federal Register* (39 FR 25522).

The establishment legislation (86 Stat. 633) states that lands to be included in the Seal Beach NWR are to be administered in accordance with the National Wildlife Refuge System Administration Act of 1966, as amended, and pursuant to plans which are mutually acceptable to the Secretary of the Interior and the Secretary of the Navy. Additional details regarding the refuge purposes are found in the Report from the Committee on Merchant Marine and Fisheries that accompanied House of Representative Bill 10310 (H.R. 10310). This report states that the purpose of the legislation to establish the Seal Beach National Wildlife Refuge is "to protect and preserve a salt water marsh and estuarine habitat valuable for migratory waterfowl and other wildlife in the State of California." Additional direction related to refuge purposes is provided in the *Management Plan for Seal Beach National Wildlife Refuge*, prepared in 1974 per the requirements of the establishment legislation. The Management Plan includes two principal objectives of the Refuge: 1) preservation and management of habitat necessary for the perpetuation of two endangered species, the light-footed clapper rail and California least tern; and 2) preservation of habitat used by migratory waterfowl, shorebirds, and other waterbirds.

1.5.5 Refuge Vision and Goals

Our vision for the future of the Seal Beach NWR is:

> *Tidal channels meandering through a sea of cordgrass deliver moisture and nourishment to support a healthy marsh ecosystem. As the quiet calm of the morning is interrupted by the clacking of a light-footed clapper rail, school children and other visitors, standing on the elevated observation deck, point with excitement in the direction of the call hoping for a glimpse of the rare bird. Shorebirds dart from one foraging area to another feasting on what appears to be an endless supply of food hidden within the tidal flats. California least terns fly above the tidal channels searching for small fish to carry back to their nests on NASA Island. A diverse array of marine organisms, from tube worms and sea stars to rays and sharks, and even an occasional green sea turtle, thrive within the tidal channels and open water areas of the Refuge's diverse marsh complex, while Nelson's sharp-tailed sparrows and other upland birds find food and shelter within the native upland vegetation that borders the marsh.*

The goals for the Seal Beach NWR include:

Goal 1: Support recovery and protection efforts for the federally and state listed threatened and endangered species and species of concern that occur within the Seal Beach NWR.

Goal 2: Protect, manage, enhance, and restore coastal wetland and upland habitats to benefit migratory birds, as well as other native fish, wildlife, and plant species.

Goal 3: Enhance public appreciation, understanding, and enjoyment of the Refuge's biological and cultural resources through outreach opportunities and quality wildlife-dependent recreation, including wildlife observation, environmental education, and interpretation.

Goal 4: Further strengthen the management partnerships between the Seal Beach National Wildlife Refuge and Naval Weapons Station Seal Beach, while preserving our respective missions.

1.5.6 History of Refuge Establishment

In 1944, the Department of the Navy (Navy) acquired about 5,000 acres of land in and around Anaheim Bay from the Alamitos Land Company. Although the Navy purchased the land, the underlying mineral rights were retained by the former owners. Following the purchase of this property, all of the submerged lands (areas below the Mean High Water Mark) within the Station were excluded from the deed and are now held in public trust by the California State Lands Commission.

Interest in establishing a Refuge at Anaheim Bay on Navy land was initiated in 1954 by waterfowl hunters seeking opportunities for public hunting areas in coastal Orange County. A number of private duck clubs had been established in the vicinity of Anaheim Bay, but there were no areas open to the general public. Supporters of public hunting areas had hoped that the Lea Act (16 U.S.C. 695-695c; 62 Stat. 238), which authorized the Secretary of the Interior to acquire and develop waterfowl and other wildlife management areas in California, would provide the funding necessary to create one or more public hunting areas in Orange County. However, the Lea Act included language stating that no sums appropriated under the Act for the acquisition of lands could be utilized unless California also set aside funds for the purchase of equivalent acreage. Due to the restrictive limitations placed on land acquisition by the State, there was no confidence that State funding would be made available for such acquisitions. As a result, waterfowl hunters approached the Service about establishing a public hunting area at Seal Beach.

In May 1954, the Service contacted the Navy, which owned the land in and around Anaheim Bay, regarding a potential hunting program on their land. The Navy responded that in the interest of public safety, hunting or any public use of its lands would not be permitted. Between 1954 and 1956, the Service made several additional proposals to the Navy for managing the Navy's lands including raising food crops to support waterfowl and permitting bow and arrow hunting of deer. The Navy expressed no interest in any of these proposals.

In 1956, the Navy expressed an interest in developing a fish and wildlife conservation program on the station. However, the upland area the Service had hoped to manage as foraging habitat for waterfowl was not available because the Navy was already in negotiations to renew a lease for agricultural use in that area. As a result, the Service turned its focus to the 500+ acres of marshland on the station. However, following a biological assessment of the area, the Service determined it would provide only limited benefits for waterfowl.

In 1961, interest in protecting the marshlands resurfaced when the Navy decided to sell some of its tidal marshland along the easterly border of the base to Orange County for development as a marina. In response to the Navy's proposal to sell a portion of the marsh, a private citizen,

Shumway Suffel, wrote the following in a letter to the Service, "I realize that this is not an ideal Refuge area for game birds, as such, but it certainly is the last refuge and hope for many marshbirds in Southern California." With knowledge that the Navy was considering releasing some of its wetlands, the Service renewed its efforts to manage the marshlands on the Navy's holdings. The Service contacted the General Services Administration about the surplus lands only to learn that the sale was completed in July 1962. Orange County acquired 63.23 acres and another 5.5 acres was sold at public auction. In August 1962, Mr. Suffel once again contacted the Service, informing them of the Navy's plan to sell additional marshland to Orange County. With this information in hand, the Service immediately arranged to meet with the Navy to express the Service's desire to manage this important coastal habitat. As a result, the Navy decided to maintain ownership of the land.

In 1963, Congressman Richard Hanna told the Service he was interested in establishing a Refuge between Huntington Beach and Seal Beach, just behind Bolsa Chica and immediately east of Highway 101. The Service responded that such an acquisition would be too costly and instead recommended designating part of the Naval Weapons Station as a waterfowl sanctuary under Defense Department Directive Number 5500.5, which required a cooperative plan for the management of fish and wildlife resources. This cooperative plan for 600 acres of tidal marsh on NWSSB was approved in 1964 through a three way agreement among the Navy, the Service, and the California Department of Fish and Game.

In 1971, significant public controversy over a proposal to construct a portion of freeway (Route 605) through the existing tidal lands prompted new discussions about establishing a Refuge at this location (Figure 1-3). Although then Secretary of the Interior Rogers C. B. Morton indicated support for the proposal, he stated that the site did not qualify for acquisition as a Refuge.

Continued controversy and public input ultimately triggered political intervention by U.S. Congressman Craig Hosmer and California State Senator Dennis Carpenter. Through the efforts of Congressman Hosmer, Public Law 92-408, authorizing the establishment of a National Wildlife Refuge on the NWSSB, was signed by President Nixon in August 1972. That same year, State Senator Carpenter was successful in amending the State Freeway Master Plan to delete the portion of the freeway that was shown to extend through NWSSB. The Refuge was officially established on July 11, 1974 when the Notice of Establishment, which included the specific boundaries of the Refuge, was published in the *Federal Register* (39 FR 25522). Describing the Refuge and its boundaries involved the approval of the *General Plan for Use of U.S. Navy Lands and Waters for Wildlife Conservation and Management* by the Secretary of the Interior and the Secretary of the Navy in 1973 and the approval of the *Management Plan for the Seal Beach NWR* by the Commanding Officer of NWSSB and Service's Regional Director in May 1974.

The approved Refuge boundary included lands held in trust for the residents of California by the California State Lands Commission and therefore required a lease agreement between the Service and the State Lands Commission to manage these areas as part of the Refuge. A 49-year lease was secured from the State Lands Commission in April 1981 for the approximately 60 acres of state tidelands that were included within the Refuge boundary.

An amendment to the "General Plan for the Use of U.S. Navy Lands and Waters for Wildlife Conservation and Management" was approved in 1992 resulting in the addition of an eight-acre parcel to the Refuge. This parcel, which is separated from the rest of the Refuge by the main channel into Huntington Harbour, is located adjacent to Pacific Coast Highway at the south end of NWSSB.

Aerial view of Anaheim Bay area with artist's conception of how proposed freeway would appear. Viewed from a point over Huntington Beach looking in a northerly and westerly direction. Photo: California Division of Highways.

Figure 1-3. Artist's Rendition of the Proposed Freeway Bisecting Anaheim Marsh

2 The Planning Process

2.1 Preparing a Comprehensive Conservation Plan

The purpose of the Comprehensive Conservation Plan (CCP) for the Seal Beach NWR is to guide the management of the Refuge over the next 15 years. The CCP and an associated EA have been prepared to meet the dual compliance requirements of the Improvement Act and NEPA. Development of the CCP is also guided by Refuge Planning Policy as outlined in Part 602, FW 1, 3, and 4 of the Service Manual (*USFWS 2000*). Service policy, the Improvement Act, and NEPA provide specific guidance for the planning process, such as seeking public involvement throughout the planning process and analyzing a "reasonable" range of management alternatives, including a "no action" alternative, that reflect current conditions and management strategies. The management alternatives analyzed in this document, including the proposed action (Alternative C), are described in detail in Chapter 3.

Key steps in the CCP and parallel NEPA processes include:

- Preplanning
- Public scoping and involvement
- Identifying issues, opportunities, and concerns
- Defining and revising vision statement and Refuge goals
- Developing and assessing alternatives
- Identifying preferred alternative plan
- Draft CCP and EA
- Revising draft documents and releasing final CCP
- Implementing the CCP
- Monitoring/feedback

Figure 2-1 shows the overall CCP steps and process in a linear cycle, but the planning process is actually a non-sequential movement among the steps, with many revisions occurring during plan development.

2.2 Preplanning

Preplanning for this CCP began in October 2006 with the establishment of a core planning team. The team consists of the Refuge Manager, a refuge planner, and other members of the San Diego NWR Complex, as well as Environmental Program staff at NWSSB. Appendix B lists the members of the planning team, as well as other participants who provided important insight regarding planning issues and ongoing refuge management. The State was invited to participate as a core team member, but due to time constraints, was not available to participate at this level. The State did however participate as part of an extended planning team.

One of the first tasks of the core planning team was to identify preliminary issues, concerns, and opportunities. To do this, the team relied on information derived from wildlife and habitat monitoring and field experience associated with the past management of the Refuge. Through this process, three primary areas of focus were identified: habitat management, endangered species

recovery, and wildlife-dependent recreation. These areas of focus were presented to the public during the scoping process to encourage input regarding the future management of the Refuge.

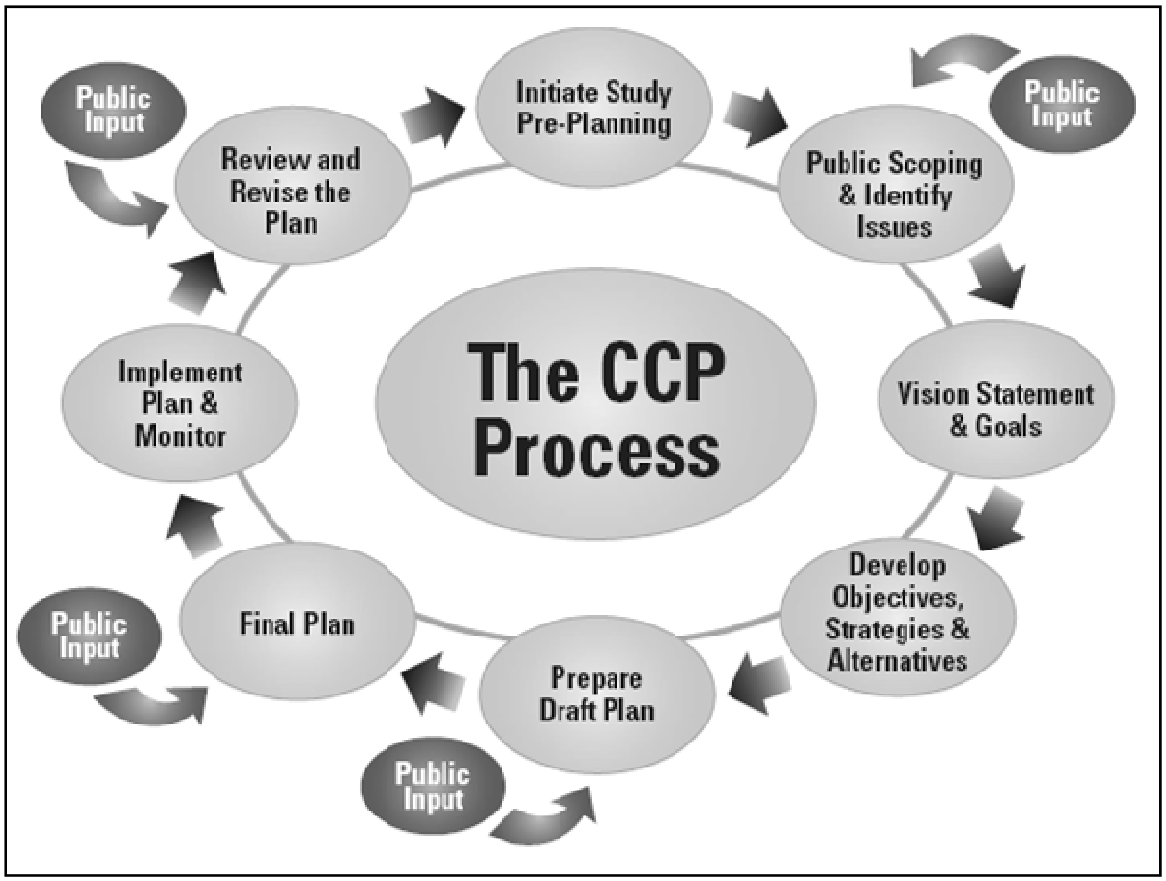

Figure 2-1. Comprehensive Conservation Planning Process

2.3 Public Involvement in Planning

Public involvement is an essential component of the CCP and NEPA process. The Service initiated the CCP planning effort for Seal Beach NWR in the *Federal Register* on April 16, 2007. In March 2007, in anticipation of the *Federal Register* notice, a newsletter or "planning update" was distributed to various agencies, organizations, Tribes, and members of the public to describe the planning process and request input regarding the future management of the Refuge. The Service also held two public scoping meetings in April 2007 to further develop and ascertain Refuge planning issues. Once the issues were compiled, a second planning update was prepared that provided interested parties with the results of the initial scoping process. A third planning update followed a number of months later to solicit public input related to the draft Refuge goals and preliminary management alternatives that were developed as a result of the initial scoping process. This draft CCP/EA represents the next step in the public involvement process. The public review process for this document will once again provide interested parties with the opportunity to provide comments and suggestions for how the Refuge should be managed.

2.4 Overview of Issues and Public Scoping Comments

The planning team identified issues, concerns, and opportunities internally and through discussions with other federal, state, and local agency representatives, wildlife and habitat professionals, and other key contacts. In addition, a variety of issues, concerns, and recommendations were received during the public scoping process that focused on topics such as wildlife and habitat management, listed species management, wildlife-dependent recreation, research, refuge operations, and expansion of the Refuge boundary. Public scoping comments were received in writing via regular mail and email and verbally at the public scoping meetings.

All of this input was compiled by the Service and taken into consideration during the development of management alternatives. This input was also used to further refine Refuge goals. A summary of the key issues and comments compiled during the public scoping process is provided below.

Habitat Management

Comments and recommendations on managing wildlife habitat ranged from improving the quality of the existing Refuge habitats to expanding the diversity of habitats within the Refuge. Suggested actions for improving the quality of the Refuge's cordgrass habitat included raising the existing elevations within the marsh and restoring seasonal freshwater flows within the marsh. Other recommendations included monitoring ongoing erosion along the edges of the marsh, controlling invasive plant and animal species within the marsh and adjacent upland areas, and monitoring water quality and tidal elevations within the marsh. Protecting salt pan habitat to support the various tiger beetle species found on the Refuge was also proposed.

Threatened and Endangered Species Management

Comments related to listed species included implementing actions to increase fledgling success for the California least tern and reestablishing the endangered plant salt marsh bird's-beak (*Cordylanthus maritimus maritimus*) on the Refuge. Suggestions were also made about expanding nesting habitat on the Refuge for the least tern and western snowy plover.

Wildlife-Dependent Recreational Use

Comments regarding public use focused primarily on expanding access onto the Refuge for wildlife observation and interpretation and implementing actions that would improve opportunities for wildlife observation such as the installation of a boardwalk along the marsh and the construction an observation tower near the Refuge office.

Research

Research projects that provide information relevant to Refuge management were encouraged.

Refuge Operations

The comments related to Refuge operations focused on the need for additional staff to implement Refuge activities, achieve Refuge goals, and support the Friends group.

Expansion of the Refuge Boundary

Two proposals to expand the current Refuge boundary were suggested during public scoping process. These included expanding the Refuge management responsibilities to include management of the Los Cerritos wetlands, located to the north of NWSSB, and incorporating Oil Island into the Refuge once it is no longer needed for oil extraction.

2.5 Management Concerns/Opportunities

In addition to the issues raised during the public scoping process, the planning team, with input from other partners, also identified several challenges, threats, and/or opportunities that will likely affect Refuge management over the next 15 years and beyond. These concerns include a number of factors (e.g., climate change, sea level rise, subsidence, and the inadvertent release of non-native terrestrial and marine species into the Refuge environment) that cannot be altered by actions undertaken by Refuge staff; instead Refuge management actions must be evaluated from time to time to adapt to these changing conditions. Other concerns that can be addressed through enhanced Refuge management actions include mammalian and avian predation of listed species and the need to increase the availability of upland refugia for marsh birds and shorebirds during periods of high tide. All of these challenges, which are described in greater detail below, were considered during the development of the alternatives presented in Chapter 3 of this document.

Climate Change/Sea Level Rise

Increasing carbon dioxide and other greenhouse gas emissions from anthropogenic sources have undeniably altered the temperature over the last century. Such temperature changes can have different consequences worldwide from sea-level rise to greater meteorological fluctuations. The Service recognizes that a changing climate will impact natural resources on refuges and has been charged by the Secretary of the Interior (Secretarial Order 3289) to include climate change in our planning processes. Anticipated impacts may include: species range shifts, species extinctions, phenological changes, and increases in primary productivity. This challenge is especially important at the Seal Beach NWR because a sea level rise of only a few inches could have significant adverse effects on the quality of the cordgrass-dominated salt marsh habitat and other intertidal habitats present within the Refuge. Intertidal habitats could slowly convert to subtidal habitat, eliminating habitat essential to the light-footed clapper rail, Belding's savannah sparrow, and other intertidal-dependent species. At present there are only limited areas of upland habitat within the Refuge that could be made available for conversion to intertidal habitat as sea level rises. The effects of climate change and sea level rise on Refuge resources, facilities, and management activities are critical components of all Refuge management decisions.

Addressing the effects of climate change and sea level rise will require coordination among a variety of agencies at all levels of government. To adequately address issues such as identifying opportunities for accommodating new intertidal habitats along the southern California coast that will support the diversity and abundance of intertidal-dependent species currently present will involve a significant commitment of time and resources. The coastal refuges of southern California (i.e., Tijuana Slough, San Diego Bay, and Seal Beach NWRs), as well as other protected coastal habitats along the southern California coast, will be important components of a future strategy for ensuring the adequate availability of intertidal habitats to support listed species, migratory birds, and estuarine fisheries. Additional discussion of climate change and sea level rise is provided in Chapter 4.

Subsidence

Both subsidence and rebound of the marsh plain within Anaheim Bay has been documented in studies conducted between 1968 and 1994. Based on the results of these studies, there appears to be a net reduction in the elevation of the marsh plain between 1968 and 1994 of between 0.18 to 0.4 feet across the marsh. The reasons for subsidence in this area is likely related to a combination of oil extraction activities in the area and historic extraction of groundwater for

agriculture and other uses. Additional details regarding the effects of subsidence on Refuge habitats are provided in Chapter 4.

Invasive Species

Non-native plant and animal species and other organisms introduced into areas where conditions are favorable for their establishment have the potential to outcompete native species when natural predators and/or competitors are not present. Under these circumstances, non-native species can cause harm to the environment, the economy, or human health. Non-native species that cause harm are collectively referred to as invasive species (*National Invasive Species Council 2008*). Invasive species such as common periwinkle (*Littorina littorea*), fountain grass (*Pennisetum setaceum*), fire ants (*Solenopsis sp.*), marine killer algae (*Caulerpa taxilfoia*), and West Nile virus, have the potential to harm native species or degrade habitat quality on the Refuge. Efforts to control invasive species on the Refuge are coordinated between the Service and NWSSB. More information about the various invasive species that could threaten the habitat quality on the refuge is provided in Chapter 4.

Predation of Listed Species

The Refuge's California least tern and light-footed clapper populations are vulnerable to predation from both mammalian and avian predators. Predation has a direct effect on the total population of rails on the Refuge, as well as on the number of least tern chicks that are successfully fledged from NASA Island each year. Predators occurring on the Refuge range from coyotes (*Canis latrans*), raccoons (*Procyon lotor*), and other mammals to crows (*Corvus brachyrhynchos*), various raptors, and great blue herons (*Ardea herodias*). Predation of young least tern chicks by gull-billed terns (*Sterna nilotica vanrossemi*) has been well-documented in southern San Diego County for several years; however, it was not until the 2009 nesting season that predation of a least tern by a gull-billed tern was documented in Orange County. The range of the gull-billed tern appears to be expanding northward and gull-billed terns were observed depredating least terns at Seal Beach NWR in 2009 and again in 2010 (pers. comm. Kirk Gilligan). In 1991, the Service and NWSSB approved an Endangered Species Management and Protection Plan (described in greater detail in Chapter 3), which addresses predator control on the Refuge. This plan does not however address predation issues related to gull-billed terns, which are protected under the Migratory Bird Act.

Contaminants

Pesticides, metals, industrial chemicals such as dioxins and PCBs, and other toxic chemicals can be carried into coastal wetlands by the tides or by surface waters carrying stormwater and urban runoff from upstream. Other pollutants may be dispersed by aerial deposition. Once present within the wetland, wildlife can be exposed to these contaminants through dermal contact, inhalation, or ingestion. Fish, invertebrates, and plants provide pathways for transporting contaminants from sediments and surface waters to other species. Fish in particular tend to accumulate contaminants in concentrations higher than those present in the sediments from which they were exposed. Bioaccumulation can occur through direct exposure to contaminated sediments or through dietary intake of other exposed organisms and has the potential to adversely affect Refuge resources, even at relatively low concentration levels. The effects, which can sometimes be hard to detect, may impair reproduction, damage the nervous system, inhibit nutrient uptake, or diminish an organism's overall health. Low concentrations of multiple pollutants can also have synergistic effects that have yet to be identified.

Refuge Access

The Refuge is situated within the boundaries of NWSSB which provides challenges with respect to public access onto the Refuge. Because the mission for NWSSB is to provide ordnance loading, storage, and maintenance support to the U.S. Pacific Fleet and other Department of Defense and Homeland Security organizations, security is a primary issue at this location. As a result, the Navy controls all public access onto the Refuge, and there may be periods when public access is prohibited for an extended period of time, as was the case following the events of September 11, 2001. Currently, all public access onto the Refuge is reviewed and approved by the Navy and supervised by Refuge staff.

Opportunities

Despite the issues and threats described above, opportunities exist for protecting the Refuge's habitat quality, listed species populations, and other trust species. These opportunities include: 1) forming partnerships with other state, local, and regional agencies to address water quality issues upstream of the Refuge, as well as in the adjacent harbor areas; and 2) working cooperatively with the Navy and others to reduce the potential for introducing invasive terrestrial and marine organisms into Anaheim Bay and its surrounding environs. Responses to the effects of climate change and sea level rise are somewhat more difficult to address at the Refuge level. Adaptive management provides an important tool for adjusting current management practices to address changing circumstances. However, to more fully address the effects of climate change and sea level rise on coastal resources will require regional or even nationwide initiatives.

2.6 Development of a Refuge Vision

A vision statement, which is developed or reviewed for each individual refuge unit as part of the CCP process, is defined as "A concise statement of what the planning unit should be, or what we hope to do, based primarily upon the Refuge System mission and specific refuge purposes, and other mandates" (Service Manual, 602 FW 1.5 (Z)). The Refuge vision provides a descriptive picture of how the Refuge will look in the future, and describes the desired future conditions in the long term (more than 15 years). The Refuge vision is presented in Chapter 1.

2.7 Development of Refuge Goals, Objectives, and Strategies

Goals and objectives are the unifying elements of successful Refuge management. They identify and focus management priorities, provide a context for resolving issues and concerns raised during the scoping process, guide specific projects, provide rationale for decisions, and offer a defensible link among management actions, Refuge purpose(s), Service policy, and the NWRS mission. In developing goals and objectives, there is a natural progression from the general to the specific. Goals define general targets in support of the Refuge vision, while objectives address the incremental and measurable steps to be taken to achieve the goals. Finally, strategies identify specific tools, actions, or techniques that would be implemented to accomplish project objectives.

The goals and objectives provide long-term guidance to Refuge managers and staff and help integrate science, improve management practices, and justify compatible use decisions. The Refuge System defines goals as a "…descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units" (Service Manual, 602 FW 1). The goals for the Seal Beach NWR are presented in Chapter 1.

Each goal is subdivided into one or more objectives. Objectives are defined as "concise statements of what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is responsible for the work" (Service Manual, 602 FW 1). The number of objectives per goal can vary depending upon the number needed to satisfy a particular goal. In cases where there are many objectives, an implementation schedule may be developed to better define when and how the strategies presented under each objective would be implemented to ensure that each objective and the overarching goals can be effectively and efficiently achieved. The objectives and strategies developed for the proposed action (Alternative C) are presented in Chapter 6.

2.8 Alternative Development Process

As indicated in Section 2.1, each CCP must comply with the provisions of NEPA. To facilitate compliance, NEPA compliance requirements have been integrated directly into the overall CCP process. This includes the requirement to analyze a reasonable range of alternatives or approaches to Refuge management that could be reasonably undertaken to achieve Refuge goals and refuge purposes; help fulfill the Refuge System mission; maintain and, where appropriate, restore the ecological integrity of each refuge and the Refuge System; and resolve identified issues. These alternatives are to consist of different sets of objectives and strategies for management of the Refuge. NEPA also requires analysis of a no-action alternative, which constitutes a continuation of current conditions and management practices.

The process of developing alternatives involves analyzing current conditions, identifying various measures that if implemented would help achieve Refuge goals, and incorporating, as appropriate, input provided during the public scoping process and other information gathered during subsequent meetings and workshops and from various interested individuals, agencies, and organizations. In Chapter 3 of this draft CCP/EA, a range of alternatives for the Seal Beach NWR CCP, including a no action and two action alternatives, are presented and an equal and full assessment of the environmental effects of each of these alternatives is presented in Chapter 5. The three alternatives described in Chapter 3 differ in the extent and focus of the wildlife and habitat management actions to be implemented on the Refuge, as well as in the types and levels of public use opportunities to be provided.

2.9 Selection of the Refuge Proposed Action

As part of the CCP planning process, we have identified Alternative C as the proposed action based on our preliminary analysis of environmental effects and Refuge issues, goals, and objectives. This alternative may be modified following the completion of the public review and comment period based on comments received from the public, agencies, and/or other stakeholders. The Final CCP will describe the preferred alternative, which may be identical to the proposed action, or could include a combination of components from one or more of the alternatives presented in the draft CCP/EA. The final preferred alternative for the Seal Beach NWR will be the management alternative that best achieves Refuge purposes, vision, and goals; helps fulfill the Refuge System mission; maintains and, where appropriate, restores the ecological integrity of the Refuge; is consistent with principles of sound fish and wildlife management; and minimizes adverse effects on the environment.

2.10 Plan Implementation

During the 15 years following CCP approval, the CCP will serve as the primary reference document for all Refuge planning, operations, and management. Chapter 6 describes how the

approved CCP will be implemented, and presents the various wildlife and habitat management and visitor services (public use) objectives and strategies for achieving the Refuge goals and purposes. In addition to management priorities, the Implementation Section also addresses personnel and project funding, current and potential partnerships, step-down management plans needed to implement the CCP, and the monitoring framework that will be used to assess the effectiveness of the plan strategies in achieving Refuge goals and objectives.

3 Alternatives

3.1 Introduction

An important step in the planning process is the development and analysis of alternatives. Alternatives are developed to identify and analyze different ways to achieve Refuge purposes, contribute to the mission of the NWRS, meet Refuge goals, and resolve issues identified during scoping and throughout the CCP process. The development of alternatives is also an important component of the NEPA process, and as described in Chapters 1 and 2, compliance with NEPA for this CCP is being accomplished through an integrated document, a draft CCP/EA, which addresses both the requirements of NEPA and the CCP process. As such, this chapter describes the process that was followed to develop a range of management alternatives for the Seal Beach NWR; provides detailed descriptions of each alternative; identifies the proposed action; compares the way in which each alternative addresses identified issues; summarizes the similarities among the alternatives; and presents alternatives that were considered, but eliminated from detailed study.

3.2 Alternative Development Process

The alternatives development process for the Seal Beach NWR was an iterative process that required consideration of a number of factors, some of which were known at the beginning of the process and others that became evident during the process as a result of public comments, analysis by the planning team, and information provided by other agencies and interested parties. The issues, constraints, and opportunities affecting management of the Seal Beach NWR (described in Chapter 2, Sections 2.4 and 2.5) were all taken into consideration during alternatives development. Also influencing this process were the Refuge purposes, as well as the vision, goals, and objectives.

One of the first steps in the alternatives development process was identifying and describing the various programs and management actions currently being implemented on the Refuge, as these practices represent the "No Action" Alternative. Under the No Action Alternative, the current management of the Refuge would continue to be implemented for the next 15 years or until management direction is revised through a revision to the CCP. It is important to describe this alternative accurately because the No Action Alternative serves as the baseline to which all other alternatives are compared.

Next, the planning team considered a wide range of management actions (or strategies) that would address the issues, constraints, and opportunities identified and would assist in achieving Refuge goals and objectives. These actions were refined during several planning team meetings and then clustered into logical groupings to form the two action alternatives. Many actions are common to more than one alternative, but the various actions described for each alternative reflect a common management approach for that particular alternative, as presented in detail below.

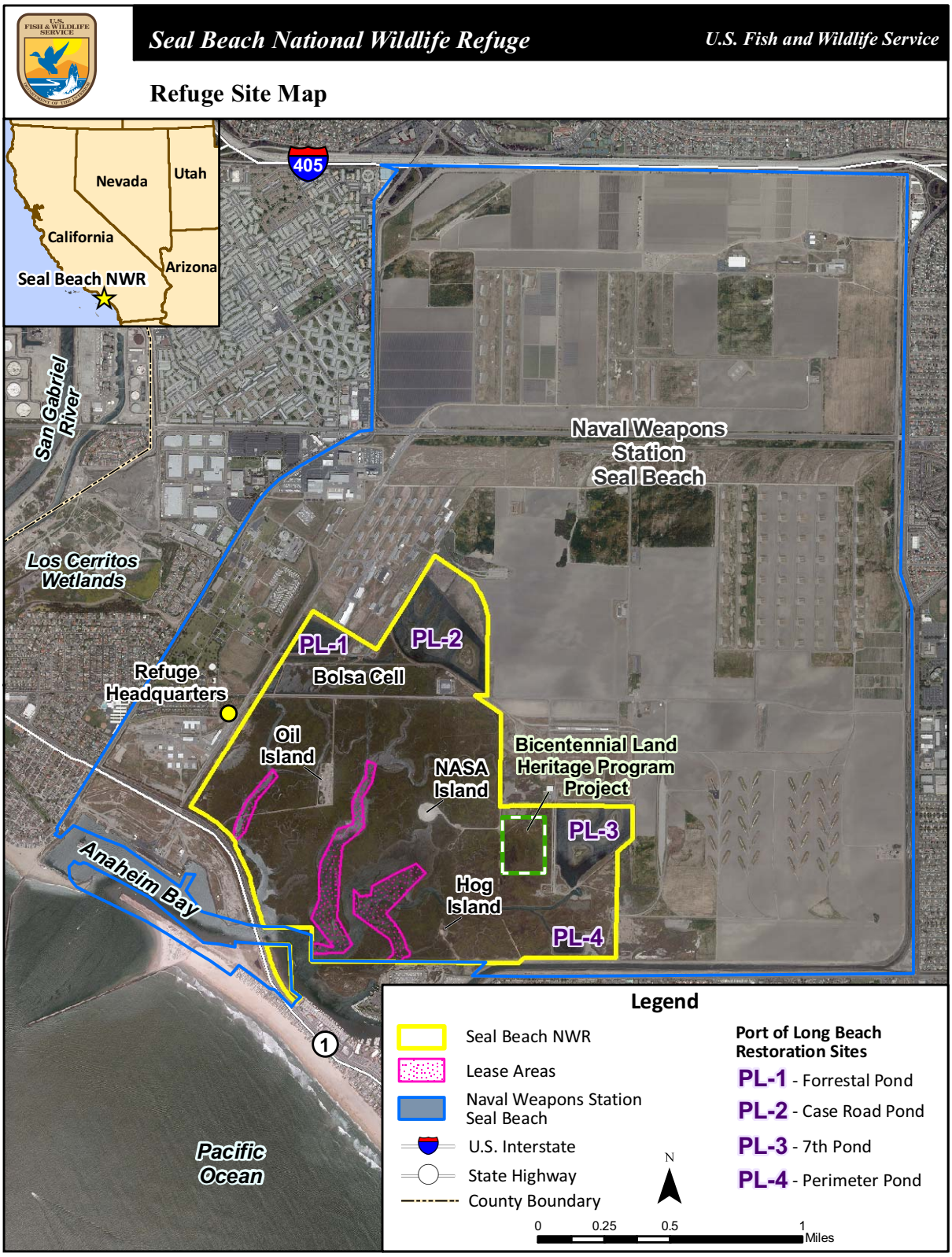

Figure 3-1. Seal Beach National Wildlife Refuge Site Map

3.3 Past and Current Refuge Management

3.3.1 Background

The Seal Beach NWR is located entirely within the boundaries of Naval Weapons Station Seal Beach, with the majority of the Refuge land and water owned by the U.S. Navy (Figure 3-1). The only exceptions are three larger tidal channels located near the south end of the Refuge. These three areas, depicted on Figure 3-1, are held by the State of California as State tidelands and leased to the Service for management as part of a national wildlife refuge. Oil Island and the two access roads that serve Oil Island are excluded from the Refuge.

3.3.2 Existing Management Plans

The first management document prepared for the soon-to-be-established Seal Beach NWR was the "General Plan for the Use of U.S. Navy Lands and Waters for Wildlife Conservation and Management, Seal Beach National Wildlife Refuge." This plan was jointly signed by the Secretary of the Interior and the Secretary of the Navy in 1973. The purpose of the plan was to identify the lands and waters within NWSSB that: 1) were available for fish and wildlife conservation; 2) were consistent with the primary and collateral purposes of the Naval Weapons Station; and 3) provided value in carrying out the National Migratory Bird Management Program. The plan stated that the specified area would be managed by the Department of the Interior for the conservation and management of migratory birds and other fish and wildlife in accordance with the National Wildlife Refuge System Administration Act of 1966, as amended, and pursuant to plans which are mutually acceptable to the Secretary of the Interior and the Secretary of the Navy. The plan further stated that the necessary details related to the management of the Refuge would be covered in a cooperative agreement to be mutually agreed to and signed by the Regional Director of the Service and the Secretary of the Navy, or his authorized representative. Finally, the plan allows for adjustments in the boundaries of the "refuge" so long as they are mutually agreed upon by the Regional Director and the Secretary of the Navy, or his authorized representative.

In accordance with the General Plan, the "Management Plan for the Seal Beach NWR" was approved in 1974 by the Regional Director of the Service and the Commanding Officer, NWSSB. The management plan amended the Fish and Wildlife Cooperative Plan that the Navy had prepared in cooperation with the California Department of Fish and Game in 1969. The 1974 Management Plan included the following objectives:

- Preserve and manage the habitat necessary for the perpetuation of two endangered species, the light-footed clapper rail and the California least tern, and

- Preserve habitat used by migrant waterfowl, shorebirds and other waterbirds.

The Management Plan prohibits hunting and fishing on the Refuge and assigns law and security enforcement to the Navy. Management of the Refuge by the Service is described as primarily for natural estuarine or salt marsh habitat. Per the management plan, any habitat manipulation requires approval by NWSSB and any non-routine activities involving Refuge visitation require prior contact with the Station Commander or his representative. Support for limited ecological studies/research on the Refuge is also included in the plan.

The Endangered Species Management and Protection Plan, approved in 1991, is the other plan that continues to provide direction to the Refuge Manager for setting management priorities. The objective of this Plan is to create and maintain a more naturally balanced ecosystem requiring minimum human intervention to support and protect endangered species. The Plan calls for the

implementation of the following actions on the Refuge and adjacent NWS: 1) species monitoring, particularly nocturnal, predatory species, California least terns, and light-footed clapper rails, to determine abundance and population trends; 2) studying the population dynamics and habitat use of the California least tern and light-footed clapper rail; 3) implementing predator control activities, including lethal take and relocation, to protect listed species particularly during the nesting season; 4) habitat management; 5) restoration and enhancement; 6) evaluation and remediation as necessary of contaminated sites; and 7) public education.

3.3.3 Management History and Past Refuge Actions

Management History

From the time the Seal Beach NWR was established in 1974 until 1991, the Refuge was managed as an unstaffed satellite of the Kern NWR Complex, located 225 miles to the northeast. The wildlife biologist assigned to the Hopper Mountain NWR also had on-site management responsibilities at Seal Beach NWR. As a result, Service staff presence on the Refuge was rare and primarily involved endangered species recovery work. The first on-site manager was assigned to the Refuge in November 1996 after the Refuge was incorporated into the San Diego NWR Complex. Seal Beach NWR is one of four refuges managed through the San Diego NWR Complex.

Today, staff for the Refuge includes one full-time permanent Refuge Manager and one part-time maintenance worker. Additional support for Refuge maintenance and management comes from dedicated Friends of Seal Beach NWR volunteers, the San Diego NWR Complex, and the Service's Coastal Program, Contaminants Program, and Ecological Services Program stationed in the Carlsbad Fish and Wildlife Office. The Refuge Manager also receives assistance from NWSSB personnel in the Environmental Programs and Services Department, Public Affairs Office, Facilities Department, and other departments responsible for operations at NWSSB.

Past Refuge Actions

The first significant habitat modification projects on the Refuge occurred in 1977. In that year, the Navy determined that the man-made 2.9-acre NASA Island site was no longer needed for military purposes and turned the site over to the Service for conversion to a least tern nesting site (Figure 3-1). From 1963 to 1974, a 40-acre section of NWSSB, including NASA Island, was granted to the National Aeronautics and Space Administration (NASA) for design and manufacture of the second stage of the Saturn V rocket as part of the Apollo program. The massive rocket stages were assembled on NSWSB and NASA Island was created for use as a rocket testing site. It was used for this purpose until the site turned over to the Service for least tern management. Prior to use as a nesting site, the site was leveled and capped with sand. In 1979, following the capping of approximately five percent of the site with clean sand and crushed shell, California least terns began nesting on the site. Nesting has occurred annually since that time.

Another project implemented in 1977 was the installation of a screw-type tide gate and headwall in Case Road to increase tidal flow to about 50 acres of degraded salt marsh habitat that was isolated from the rest of the marsh when Case Road was constructed. Today, this area is referred to as the Bolsa Cell. Once installation was completed, tidal flows into this area were controlled seasonally. In the winter, tidal influence into the marsh habitat was increased to support shorebirds and waterfowl, and in the summer the gate was closed to reduce the potential for mosquito breeding.

In 1979, the Refuge was awarded $185,000 in Bicentennial Land Heritage Program funds to restore approximately 165 acres of salt marsh habitat located to the south of the small weapons range parcel between 7th Street and Case Road (refer to Figure 3-1). The project, which began in 1981 and was completed in the spring of 1982, involved removing old fills and dikes to restore tidal

flows to the historic marsh area and improve the diversity and productivity of the wetland habitat. The primary objective was to increase foraging and nesting areas for the light-footed clapper rail.

Also, in 1981, the Navy in coordination with the Service and California Department of Fish and Game, replaced several collapsed metal culverts under Bolsa Avenue. This project improved tidal flushing for about 50 acres of degraded salt marsh habitat in the Bolsa Cell.

In 1982, 1985, and 1986, several attempts were made to re-establish salt marsh bird's beak on the Refuge in an upland transition area located along Kitts Highway to the south of Bolsa Avenue. Although many of the introduced seeds germinated and the plants produced flowers, the plants never spread and eventually died out (refer to Chapter 4 for further information).

In 1982 and 1985, two projects were implemented to create nesting mounds for light-footed clapper rails within the Refuge. The first involved constructing five hummocks above the extreme high tide level near the northeast corner of the Refuge, to the south of Bolsa Avenue. Unfortunately, wind wave and tidal erosion quickly reduced these mounds to lower than optimal elevations. The second project involved creating 11 nesting mounds in three separate locations along an existing berm that extended south from the southern terminus of Case Road. More successful management of light-footed clapper rail nesting began in 1987 with the installation of 28 floating nesting rafts in the marsh. This management activity, which is also addressed in Chapter 4, continues today.

The largest restoration project implemented on the Refuge was the Port of Long Beach Mitigation Project. This $7 million project, which enhanced and reclaimed approximately 116 acres of tidally influenced wetland habitat, began in 1989 and was completed in early 1990. Following project completion, biological monitoring of birds, fish, invertebrates, and vegetation was conducted for a period of five years. Additional information about this restoration project is provided in Chapter 4.

In 1986, the Service and Navy prepared an environmental assessment to address the environmental consequences of implementing predator management on NWSSB to protect listed species. A major emphasis of the proposal was the control of non-native red foxes which had become established on the Station and represented an immediate threat to the survival of the California least tern and light-footed clapper rail populations on the Refuge. A law suit was brought against the Service and the Navy in July 1986 that required the preparation of an EIS prior to implementing any further predator management to control the red fox. An EIS was prepared and following the issuance of the Record of Decision in 1991, the Endangered Species Management and Protection Plan was approved and control of red foxes was initiated.

In 1996, 3,000 cubic yards of sand from Shellmaker Island in Newport Beach was spread over a portion of the least tern nesting site on NASA Island to enhance nesting habitat for the terns. In 2004, a layer of salt was applied to a portion of the nesting area in an effort to reduce the numbers of weedy plants emerging on the site after the winter rains. Nesting substrate was again enhanced in 2007, when crush oyster shell was spread over a portion of the nesting site.

3.3.4 Coordination with NWSSB

As a Refuge that overlays NWSSB, management of the Seal Beach NWR must be consistent not only with the Refuge purposes and goals and the mission of the NWRS, but also with the mission of NWSSB. Unlike the "wildlife first" mission of the NWRS, the mission for NWSSB is to provide ordnance loading, storage, and maintenance support to the U.S. Pacific Fleet and other Department of Defense and Homeland Security organizations. While the primary focus of the

activities at NWSSB are directed toward achieving this mission, there are also various actions taken at NWSSB to conserve the Station's natural resources. Existing laws and regulations, such as the Sikes Improvement Act of 1997 (Sikes Act), provide guidance for achieving a balance on military lands between ensuring the continued support of the military mission and protecting natural resources.

The "General Plan for Use of U.S. Navy Lands and Waters for Wildlife Conservation and Management, Seal Beach National Wildlife Refuge" states that the Secretary of the Interior shall administer the lands and waters identified by the Navy as available for fish and wildlife conservation and management purposes pursuant to plans which are mutually acceptable to the Secretary of the Interior and the Secretary of the Navy. As such, coordination with NWSSB to ensure that management is consistent with the primary and collateral purposes of the Station is an essential part of the Refuge management program at Seal Beach NWR. The Refuge Manager coordinates habitat and wildlife management and public use activities with the Commanding Officer and various appropriate departments at NWSSB. Coordination occurs most often with the Environmental Programs and Services Department, Public Affairs Office, Security Department, and Facilities Department. The NWSSB also provides funding for some of the management actions implemented on the Refuge.

To continue cooperative management within the Refuge, the Service has been coordinating with staff from NWSSB in the development of this CCP. At the same time, NWSSB, in accordance with the Sikes Act, has been coordinating the completion of the Integrated Natural Resources Management Plan (INRMP) for NWSSB. The purposes of a CCP and an INRMP are similar in many ways. Both provide a framework for managing natural resources on lands owned or controlled by the entity preparing the plan. Just as CCPs are required for all Refuges, the Sikes Act has committed the Department of Defense to develop INRMPs for all of its military installations. An INRMP is intended to help installation commanders manage their natural resources in a manner that is consistent with sustainability of those resources and to ensure continued support of the military mission. At NWSSB the INRMP is ecosystem based and is developed in cooperation with the Service and the California Department of Fish and Game.

3.3.5 Current Refuge Management

The Management Plan for the Seal Beach NWR, the Endangered Species Management and Protection Plan, and applicable recovery plans and bird conservation plans provide the basis for the current management activities being implemented on the Refuge. Between the late 1980s to today, Refuge management has involved monitoring of listed species; implementation of predator management; control of invasive upland plants; maintenance of NASA Island to optimize conditions for least tern nesting; repair or replacement of light-footed clapper rail nesting platforms; maintenance, and where necessary, replacement of culverts that facilitate tidal flow within the main marsh and adjacent restored wetlands; and planting of native upland plants in disturbed upland areas.

The majority of the wildlife and habitat management activities being conducted on the Refuge are directed primarily at the protection and management of the Federally listed endangered California least tern and light-footed clapper rail, both of which nest on the Refuge. However, these and other activities conducted on the Refuge also provide benefits to the other native species that are supported on the Refuge.

The Refuge Manager is also responsible for ensuring the protection of cultural resources; coordinating issues related to contaminants with the Navy and the Service's Environmental Contaminants Program; and coordinating with the Navy on activities occurring on the Refuge

related to public use. A detailed description of the wildlife and habitat management activities currently being implemented on the Refuge, as well as the Refuge's current public use program, are described in detail in Section 3.3.3.1 (Alternative A - No Action).

3.4 Proposed Management Alternatives

Before the process of developing alternatives began, the planning team reviewed and evaluated both the comments received during the initial phases of the CCP planning process, including scoping, as well as the issues, management concerns, threats, and opportunities presented in Chapter 2 of this document. Through further analysis of the issues and general public comment, the team developed various objectives for achieving Refuge goals, the mission of the NWRS, and other mandates. Based on the objectives and an analysis of the types of strategies that might be implemented to achieve the objectives, a range of draft alternatives were developed for how the Refuge should be managed over the next 15 years. These draft alternatives were further refined during the analysis of environmental consequences.

As a result of this process, three management alternatives, including a no action alternative and two action alternatives, were developed for evaluation in the draft CCP/EA. The three alternatives differ in the extent and focus of wildlife and habitat management actions to be implemented on the Refuge and in the types and levels of public use opportunities to be provided. Management Alternative "C" represents the proposed action. Following consideration of the comments received during public review of the draft CCP/EA, this alternative may be altered to include one or more of the actions addressed in another alternative, or some elements of the alternative may be modified or deleted. The preferred management alternative will be described in the Final CCP.

3.4.1 Summary of Alternatives

The three management alternatives evaluated for the Seal Beach NWR are summarized below and described in greater detail in the sections that follow.

Alternative A - No Action

Under this alternative, past and present management activities would remain unchanged. Current conservation and management actions would continue per available funding and wildlife observation, interpretation, and environmental education would continue at current levels. This alternative represents the baseline from which other "action" alternatives will be evaluated.

Alternative B – Maximize Salt Marsh Restoration, Continue Current Public Uses

Under this alternative, current wildlife and habitat management activities would be expanded to include evaluation of current baseline data for fish, wildlife, and plants on the Refuge, identification of data gaps, implementation of species surveys to address data gaps as staff time and funding allows, and support for new research projects that would benefit Refuge resources and Refuge management. Also proposed is the restoration of approximately 22 acres of intertidal habitat (salt marsh and intertidal mudflat) and 15 acres of wetland/upland transition habitat. Pest control would be implemented in accordance with an Integrated Pest Management program and mosquito monitoring and control would be guided by a Mosquito Management Plan. No changes to the current public use program are proposed.

Alternative C (Proposed Action) - Optimize Upland/Wetland Restoration, Improve Opportunities for Wildlife Observation

The majority of the management activities proposed in Alternative B would also be implemented under this Alternative. The primary difference between Alternatives B and C is that under

Alternative C a larger portion of the areas to be restored would consist of upland and wetland/upland transition habitat. Under this alternative, approximately 12 acres would be restored to upland habitat, approximately 10 acres would be restored to wetland/upland transition habitat, and approximately 15 acres would be restored to intertidal habitat. In addition, Alternative C includes limited expansion of the current public use program, including expanded opportunities for wildlife observation.

3.4.2 Similarities Among the Alternatives

Although there are differences among the range of alternatives presented for managing the Seal Beach NWR, the alternatives also include various features and management components that would be part of the CCP regardless of the alternative selected for implementation.

3.4.2.1 Features Common to All Alternatives

Features common to all alternatives are summarized below. To reduce repetition in the alternatives descriptions, those features that are common among all of the alternatives are described in detail only under Alternative A – No Action.

- *Monitoring of Listed Species* – Annual monitoring of California least terns and light-footed clapper rails would continue, per available funding. Monitoring involves site visits during the nesting season for both species to record numbers of pairs and nests, and to estimate the numbers of chicks fledged. Fall high tide and spring call counts for rails are also conducted.

- *Management of NASA Island to Support California Least Tern Nesting* – Site preparation prior to the nesting season would continue at NASA Island, as would measures to reduce the potential for predation by mammalian and avian species.

- *Actions to Improve the Reproductive Success and Genetic Diversity of the Refuge's Light-footed Clapper Rail Population* – Nesting platforms installed in the marsh improve the rails' potential to successful raise their young. Annual inspection, maintenance, and replacement of these platforms would continue under all alternatives. In addition, periodic releases of captive-bred rails would continue to ensure genetic diversity within the population.

- *Mosquito Monitoring and Control* – Under all alternatives, the Orange County Vector Control District would be allowed to monitor and manage mosquito populations on the Refuge for public health and safety purposes. These activities are permitted through the issuance of annual Special Use Permits.

- *Invasive Plant Species Control* – Periodic control of invasive plant species, involving the use of Service approved herbicides, would be conducted in upland and upland transition areas of the Refuge. Service approved pesticides (which include herbicides) would be used under all alternatives. Pesticide approvals would include a detailed evaluation of the proposed pesticide noting environmental hazards, efficacy, vulnerability of the target pest, and the State-issued Certified Pesticide Applicators' identification number for proposed use of any restricted use pesticides.

- *Upland Habitat Enhancement* – In disturbed upland areas, such as along existing roadways, appropriate native plant material (i.e., specimen plants or seeds) would be installed following invasive plant species control to enhance habitat quality in these areas.

- *Trash and Debris Removal* – Periodic volunteer events to remove trash and debris from upland and upland transition areas, as well as along the edges of the marsh, would continue to be held under all alternatives.

- *Culvert Maintenance* – Culverts would continue to be periodically inspected, cleaned, and/or replaced to ensure that adjacent wetland areas are receiving adequate tidal flow.

- *Coordination with NWSSB* – The Service would continue to coordinate with personnel at NWSSB to ensure that the mission of both the Navy and NWRS are being met.

- *Support for the Friends of Seal Beach NWR* - The Service would continue to support the activities of the Friends of Seal Beach NWR, who assist in management activities, tending of a native plant garden, and public outreach.

- *Environmental Contaminants Coordination* – The Refuge Manager would continue to work with the Navy and the Service's Environmental Contaminants Program to ensure that trust resources are not being adversely affected by contaminants originating on site, as well as from offsite sources.

- *Protection of Cultural Resources* – Recorded and any yet to be discovered cultural resources located within the Refuge would be managed in accordance with existing Federal laws and Service and Navy policies. The Refuge Manager would continue to consider the effects of all proposed actions on cultural resources and prior to implementing any ground-disturbing projects, would consult with Service and NWSSB cultural resources personnel, and, when appropriate, the SHPO, federally recognized Tribes, and interested parties.

- *Wildlife Observation* – Opportunities for wildlife observation would continue to be provided.

- *Interpretation and Environmental Education* – The Friends would continue to assist in the implementation of on- and off-Refuge environmental education programs, and interpretive signs and presentations would be available at the Refuge.

- *Facilitation of Scientific Research* – Under any alternative, scientific research activities would be encouraged, provided the activities are consistent with Refuge purposes and the mission of the NWRS.

- *Predator Management* – Predator management would continue to be implemented in accordance with the Endangered Species Management and Protection Plan, approved by the Service and Navy 1991.

3.4.2.2 Features Common to All Action Alternatives

- *Endangered Species Management* – To aid in the recovery of the light-footed clapper rail and California least tern, the Refuge Manager will work with the NWSSB to reduce the number of perching opportunities for avian predators around the marsh. Additionally, the Refuge Manager will implement a study to better understand the habitat qualities and species dynamics of the natural rail nesting areas located between Hog Island and Perimeter Pond in order to determine if these conditions can be replicated elsewhere on the Refuge.

- *Integrated Pest Management (IPM)* – Pest management on the Refuge would be implemented through an integrated pest management approach. The draft IPM Plan (Appendix C) presents a comprehensive, environmentally sensitive approach to managing pests that includes a combination of strategies that pose the least hazard to people, property, and the environment.

- *Mosquito Management Plan* – Mosquito management, including monitoring and control, is conducted by the Orange County Vector Control District through a Refuge Special Use Permit. The Mosquito Management Plan (Appendix D) presents an integrated pest management approach to mosquito control on the Refuge and provides the Refuge Manager with guidance on how this approach to mosquito control should be addressed in future Special Use Permits.

- *Replacement of the Western Culverts in the Bolsa Cell* – The deteriorating culverts at the western end of the Bolsa Cell would be removed and a new water control structure would be installed near the center of the levee to improve tidal exchange and allow for better regulation of water levels within the cell.

- *Removal of Concrete and Other Debris* – Remnants of concrete structures and other debris would be removed from the marsh per available funding.

- *Expanded Invasive Plant Control* – Through a coordinated effort with NWSSB, invasive plant control would be implemented on NWSSB lands around the perimeter of the Refuge. Partnering with the NWSSB, the Refuge Manager would also seek to actively control aggressive invasive weed species growing along agricultural fields and around weapons magazines on the NWS.

- *Document the Health of the Refuge's Cordgrass Habitat* – A field study documenting the current health of the cordgrass stands within the Refuge would be initiated per available funding. The study would also include an evaluation of those factors that could be inhibiting optimum plant health, density, and height.

- *Increase Efforts to Inventory Refuge Species* – Directed searches for tiger beetles, an inventory of native plant species, vertebrate and invertebrate surveys, and updated fish species data for Anaheim Bay would be implemented by Refuge staff or others as funding for these studies is identified.

- *Implement Water Quality Monitoring* – A water quality monitoring program to regularly collect data regarding the basic physical parameters of the waters within the Refuge would be implemented per available funding.

- *Monitor Tidal Channel Bathymetry and Channel Bank Stability* – Tidal channel bathymetry and channel bank stability would be monitored annually to determine changes related to erosion and/or sedimentation.

- *Expand Opportunities of Research* – Research projects that are consistent with Refuge purposes and the mission of the NWRS would be identified for implementation on the Refuge to benefit Refuge resources and improve management effectiveness.

- *Monitor Changes Related to Climate Change and Sea Level Rise* – Funding and partnerships would be sought to routinely monitor and record tidal elevations, changes in habitat quality and/type over time, and changes in avian and fish species composition to better understand and address the effects of climate change and sea level rise on Refuge resources.

- *Improve the Quality of Runoff Entering the Marsh* – Through the formation of a multiple agency partnership, measures to reduce water pollution levels in the Bolsa Chica and East Garden Grove-Wintersburg flood control channels would be designed and implemented.

- *Restore Native Habitat* – Habitat restoration would be implemented on approximately 37 acres of disturbed upland within the Refuge. The types of habitats to be restored vary among the two action alternatives.

3.4.3 Detailed Description of the Alternatives

3.4.3.1 Alternative A - No Action

The No Action Alternative (Figure 3-2) proposes no changes to the present management or public use activities occurring on the Refuge. However, as is the case today, if the Navy were to determine that the mission of NWSSB could be compromised by the public use activities currently occurring on the Refuge, these activities could be curtailed or eliminated.

Wildlife and Habitat Management

The majority of the wildlife and habitat management activities occurring on the Refuge are being implemented in accordance with the approved Endangered Species Management and Protection Plan (Protection Plan) (*USFWS and Navy 1991*). The primary objective of this plan was and continues to be the establishment of a more naturally balanced ecosystem to support the endangered species and other native wildlife occurring within the Refuge and surrounding NWSSB. To achieve this objective, two important milestones had to be achieved: 1) eliminate the non-native population of red fox on the Refuge and adjacent Station; and 2) reestablish a coyote population to maintain a healthy predator balance. Both of these

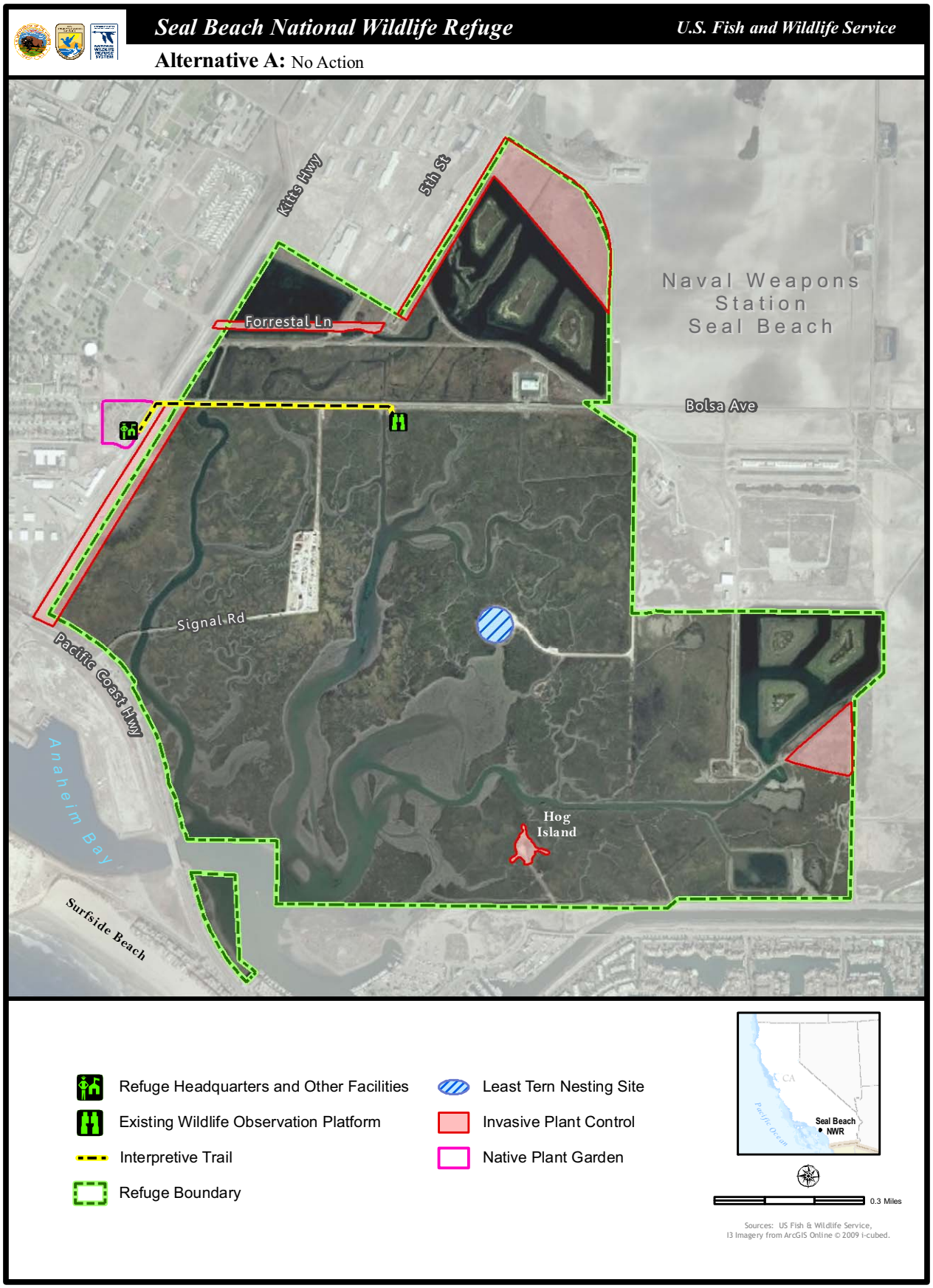

Figure 3-2. Alternative A

milestones have been achieved. Other plan components include: species population monitoring; endangered species studies; endangered species protection; predator control; habitat restoration and enhancement; monitoring and researching environmental quality; public use and education; and staff and funding. The Protection Plan, which is incorporated by reference into the CCP/EA, serves as the Refuge's "step-down" plan for predator management, which is discussed in greater detail below.

Refuge cleanups involving volunteers and Refuge staff are organized periodically to remove trash and other debris from the edges of the marsh and adjacent uplands. Refuge staff works with the Navy to have more significant debris, such as old pieces of pipe, tires, and large pieces of wood that have been pushed into the Refuge by high tides, removed from the marsh.

Concrete debris located to the southeast of NASA Island has been identified as remnants of a structure associated with a "plugged and abandoned – dry hole" as listed on the California Division of Oil, Gas, and Geothermal Resources website. This is actually the site of an abandoned oil well that was drilled in 1929. It was abandoned and capped in 1930 by CalResources LLC. The total depth of the drill hole is 4,573 feet, of which 972 feet is metal casing filled with cement. Although there was a requirement to remove all visible structures as part of the original abandonment process, the concrete associated with the well is still present on the site. The area affected by the abandoned well is less than 500 square feet in size.

The current responsible party for this site has been identified and has agreed to remove the remaining structures. Removal and clean-up will require the use of heavy equipment to break up an estimated 1,400-1,600 metric tons of concrete and to load trucks that will haul the concrete material to an appropriate off-Refuge disposal site. Where footings go below the surface of the ground, several feet of the concrete located below the surface will be removed and the disturbed area will be filled with clean material to reestablish the historic marsh elevation. In addition, the well pipe head may be lowered to beneath ground level as part of this project. Any vegetation or dirt currently on top of concrete will be salvaged and replaced upon completion of project. Temporary dams and dewatering may be required to limit the tidal flow into the work area while removing the footings. Once all of the structures are removed and the proper elevations have been achieved, native salt marsh vegetation appropriate to this site will be planted to accelerate site restoration.

Work at the site will be limited to September 15 through February 1 to avoid impacts to nesting least terns and light-footed clapper rails. Any work lighting will be fully shielded to prevent light from spilling into adjacent habitat areas, and best management practices will be implemented to protect water quality and habitat. These conditions will be outlined in a Refuge Special Use Permit to be issued to the contractor prior to commencement of any work on the site. Similar conditions will likely be required by NWSSB, which will also need to approve this work. The project will also be required to comply with the provisions of the Clean Water Act, the Endangered Species Act, the Coastal Management Act, and NEPA.

<u>Endangered, Threatened, and Sensitive Species Management</u>. A number of actions are implemented on the Refuge specifically to protect and aid in the recovery of the California least tern and light-footed clapper rail. These include annual pre-nesting site preparation, predator management, and population monitoring. Population monitoring is conducted to determine species abundance and ongoing population trends on the Refuge and endangered species studies are conducted per available funding to study population dynamics and habitat use by least terns and clapper rails.

For the California least tern, annual pre-nesting site preparation involves killing weedy vegetation at the NASA Island nesting site through the use of chemical or mechanical means; cleaning up any debris and/or trash; improving substrate quality when necessary by spreading additional clean, light sand and shell fragments over some or all of the site; inspecting and repairing the electrified perimeter fence; and addressing any erosion problems around the outer edges of the nesting site. In 2007, approximately 40 percent of NASA Island was mechanically scraped and clean, light sand was deposited over the prepared area. Volunteers then assisted in manually removing vegetation from the remainder of the site. This was followed in 2008 by the placement of crushed oyster shells on those areas of the site that were recently covered in clean sand. Vegetation growing on the site is normally killed in late winter through use of approved herbicides or salt water treatments.

California least tern monitoring begins at NASA Island when the first least terns are observed on the Refuge, which is generally between April and early May of each year. Monitoring is conducted one day per week until the terns leave the nest site, which usually occurs in late July or August each year. To monitor the nesting terns, terra cotta tiles are placed inside the colony for grid marking. These tiles also provide protection for tern chicks from avian predators. The grid spacing is generally set at 30 feet. This grid assists the tern monitors in recording and mapping tern nests. Monitoring data provide information about the number of adults present at the nesting site, the numbers of nests, chicks, and successful fledges, and information about adult, chick, and/or egg mortality and/or predation. This monitoring data are provided to the California Department of Fish and Game for inclusion in the statewide California Least Tern Annual Report and are also maintained at the Refuge Headquarters for use in comparing population levels and productivity from year to year and over extended periods of time.

To reduce the potential for predation by avian predators, particularly crows, ravens, and gulls, a least tern predator monitoring program is implemented annually on the Refuge during the nesting season. This program, often referred to as the Eyes on the Colony Program, involves the use of volunteers and/or contractors who are stationed at a lookout site a short distance from the nesting colony. From this location, they can observe the activities going on at the nesting site. When participants observe potential avian predators in the vicinity of the nesting colony, they take actions to haze (scare off) the potential predators from entering the site. Participants stay in contact with the Refuge Manager to provide updates on site conditions and nesting activity, as well as to report potential threats or apparent evidence of predation activity.

Pre-nesting season preparation for the light-footed clapper rail involves conducting annual inspections of, and when necessary, repairs to the clapper rail nesting platforms that have been placed within the marsh (refer to Chapter 4 for additional information). Navy contractors and Refuge volunteers assist the Refuge Manager in this task. The design of these platforms is continually being improved to ensure that the rails have safe and secure locations to nest and take refuge during higher high tide events that occur throughout the year. Each year a number of new platforms are placed within the marsh to replace old or damaged platforms. From 2003 to 2008, the total number of nesting platforms located within the Refuge was between 79 and 82 (*Hoffman 2009*).

Light-footed clapper rail monitoring involves annual fall high tide counts and spring call counts. Fall high tide counts are conducted at least once a year in the fall during daytime +6.7 foot or higher tides in order to estimate the overall Refuge population. Spring call counts are conducted annually during early phases of rail breeding, usually in March or April in order to

estimate population size, composition, and breeding status. Monthly monitoring of clapper rail nesting platforms and natural nesting areas are conducted throughout the nesting season by Navy contractors, generally February through July or August of each year. Monitoring is conducted to identify nest locations, gather information about breeding success, predation, signs of the presence of predators in the area, and any other breeding biology information that could be useful in adapting current management and/or monitoring techniques. Rail sightings are also recorded during the Refuge's monthly high tide and low tide bird counts.

To reduce disturbance to rails, public access on the Refuge is generally limited to areas located away from potential rail habitat. Activities such as trash and debris clean-ups that occur along the edge of the marsh are conducted outside of the clapper rail nesting season.

Over the past several years, captive-bred light-footed clapper rails have been released on the Refuge in an effort to increase the genetic diversity of the rail population. Additional releases may occur in the future if monitoring indicates that low population levels warrant such action.

Another important management activity implemented to protect least tern and clapper rail adults, chicks, and eggs is predator management. Implemented throughout the nesting season in accordance with the Endangered Species Management and Protection Plan (*USFWS and Navy 1991*), predator management involves monitoring for signs of the presence of potential predators in the vicinity of least tern and light-footed clapper rail nesting habitat areas, and implementing predator control as necessary to protect listed species. The details of the Refuge's predator management plan are discussed in detail below.

Management actions to support the State endangered Belding's savannah sparrow include limiting human disturbance in and around the marsh during the nesting season; minimizing disturbance in occupied Belding's habitat throughout the year; and accommodating the State-wide Belding's savannah sparrow survey that is conducted approximately every five years.

General Site Management. General site management involves the control of invasive plant species, native plant installation, and trash and debris removal. These activities result in improved wetland and upland habitat quality that benefit the array of species supported on the Refuge. Invasive plant removal includes both mechanical and chemical control methods, with control focused on invasive, weedy plant species present in the Refuge's upland and upland transition areas, including the upland area north of the Case Street Pond, the area southeast of the 7th Street Pond, Hog Island, and all other upland edges bordering the salt marsh. When controlling invasive plants using chemical methods, Refuge staff applies herbicides to target plants or cut stumps by using spray bottles, backpack sprayers or a tank and hose mounted on a gator or other type of "all terrain vehicle" (ATV).

All herbicides used on the Refuge must be reviewed and approved as part of the Service's Pesticide Use Proposal System (PUPS). The PUPS identify specific pesticides approved for use on each Refuge, and includes details on target pests, products applied, application dates, rates, methods of use, number of applications, site description, sensitive habitats, and best management practices to avoid impacts to sensitive resources. All herbicides used on the Refuge must be reviewed and approved as part of the Service's Pesticide Use Proposal System (PUPS). The PUPS identifies specific pesticides approved for use on each Refuge, and includes details on target pests, products applied, application dates, rates, methods of use, number of applications, site description, sensitive habitats, and best management practices to avoid impacts to sensitive resources. Pesticide use on the Refuge also conforms to the requirements of the Navy's approved Integrated Pest Management Plan for NWSSB, which

requires that all pesticides used on the Refuge be approved by the Navy prior to initial use. Additionally, the details of pesticide application on the Refuge are to be documented in the Navy On-line Pesticide Reporting System.

The herbicides currently approved for use on the Refuge include Aquamaster and Glyphoste Pro 4, with the active ingredient glyphosate; Habitat, with the active ingredient imazapyr; and Surflan AS, with the active ingredient oryzalin. Table 3-1 provides information regarding the specific uses and application of each of these pesticide products on the Refuge.

Table 3-1
Current Pesticide Use Information for the Seal Beach NWR

PRODUCT NAME	GLYPHOSATE PRO 4	AQUAMASTER	HABITAT	SURFLAN AS
Active Ingredient	Glyphosate (post-emergent herbicide)	Glyphosate (post-emergent herbicide)	Imazapyr (pre- and post-emergent herbicide)	Oryzalin (pre-emergent herbicide)
Target Pests	Non-native, invasive broadleaf weeds/grasses	Non-native, invasive broadleaf weeds and shrubs	Perennial pepperweed, Brazilian pepper tree, other invasive shrubs/trees	Non-native, invasive annual grasses, broadleaf weeds, and woody shrubs
Treatment Site	terrestrial	terrestrial areas immediately adjacent to wetlands	terrestrial	terrestrial
Treatment Area Size	30 acres	30 acres	5 acres	30 acres
Application Method **Application Rate** **Application Equipment**	Foliar (low volume) 5% solution ATV sprayer	Foliar (low volume) 2% solution ATV sprayer Foliar (low volume) 5% solution ATV sprayer	Foliar (low volume) 5% solution Backpack Sprayer Cut Surface 66% solution Hand-held	Soil application 2 quarts/acre ATV sprayer Soil application 4quarts/acre ATV sprayer
Applications/year	2 applications/year	2 applications/year	2 applications/year	3 applications/year
Best Management Practices	Only apply when wind speeds are less than 10 mph; Do not apply during inversion conditions; Follow label instructions; Calibrate application equipment; and Monitor site prior to application	Only apply when wind speeds are less than 10 mph; Do not apply during inversion conditions; Follow label instructions; Monitor site prior to application; Provide buffer between sensitive areas and application area	Only apply when wind speeds are less than 10 mph; Do not apply during inversion conditions; Follow label instructions; Calibrate application equipment; and Monitor site prior to application	Only apply when wind speeds are less than 10 mph; Do not apply during inversion conditions; Follow label instructions; Calibrate application equipment; and Monitor site prior to application

Mechanical methods used to remove invasive plants can include digging by hand, a nylon filament trimmer (weed "whacker"), chain saw, uprooting the plant with a jack or hand pulling, among other mechanical methods. The areas where weed removal occurs are generally seeded or planted with native plant species.

Other management activities include protecting and maintaining existing native upland plant restoration areas near Hog Island, Kitts Highway, Bolsa Avenue, the eastern edge of the 7th Street Pond, and to the north of Case Street Pond; supporting the Navy's efforts to conduct eelgrass surveys in Anaheim Bay; and cooperating in assessing the performance of the Refuge's tidal mitigation areas using the California Rapid Assessment Method. Also implemented when funding can be secured is the maintenance, and where necessary replacement, of existing culverts to enhance or restore tidal flow within the main marsh and adjacent restored wetlands.

Night mammal surveys are conducted on the Refuge and the adjacent NWS in partnership with the NWSSB. These surveys are conducted to assess the population of potential mammalian predators that could adversely affect listed species. Volunteers also conduct monthly high tide and low tide bird counts; the National Audubon Society conducts its annual Christmas bird count; and a variety of research projects (e.g., round stingray surveys, *Trematode* surveys, ghost shrimp study, invasive snail [*Littorina littorea*] surveys) are conducted on the Refuge that provide relevant information about Refuge resources or data that can benefit Refuge management. These scientific investigations require a Special Use Permit from the Refuge Manager.

Predator Management. Monitoring for the presence of mammalian and avian predators that could pose a threat to the California least tern nesting colony and/or the light-footed clapper rail population on the Refuge is an important component of the Refuge's wildlife and habitat management program. Predator management continues to be implemented in accordance with the Endangered Species Management and Protection Plan (*USFWS and Navy 1991*), which addresses predator management throughout NWSSB, including the Refuge.

The Endangered Species Management and Protection Plan (*USFWS and Navy 1991*) is a comprehensive plan that includes species population monitoring, endangered species studies, endangered species protection, predator control, habitat management, habitat restoration and enhancement, and monitoring and researching environmental quality. An objective of the plan is to establish a more naturally balanced ecosystem within the Refuge and NWSSB that is supportive of endangered species and other native wildlife. The principal means for providing endangered species protection on the Refuge involves habitat modification and population management. All methods used for controlling predators on the Refuge are implemented in conformance with government regulations and have been approved subject to Service and U.S. Department of Agriculture, Animal Damage Control guidelines and requirements.

Predator management on the Refuge includes indirect and direct control of predators. Indirect control includes maintenance of barriers and fencing around NASA Island and the "Eyes on the Colony" volunteer program. Direct control includes live capture and release off-site, live capture and euthanization, shooting, and toxicant application.

In general, predator species are controlled based on location, seasonality, and number of predator signs or sightings. The following factors are considered before implementing control of a particular predator: the nature and degree of threat to endangered species; the estimated population of the predator species; location of the predator sightings and signs to endangered

species habitat; the season during which the predator is present; and the level of vulnerability of endangered species to the particular predator species. Based on the specific criteria associated with these factors, various actions are taken to assure that endangered species protection and population objectives are achieved while avoiding excessive removal of predatory animals.

The control of mammalian and avian species with the potential to harm the Refuge's listed species is currently conducted by the Refuge Manager. In the past, this activity has been implemented by an outside contractor who maintains regular contact with the Refuge Manager. At the end of each breeding season, a predator management report describing the monitoring and control methods implemented during the past year is prepared and kept on file in the Refuge Headquarters. Control methods can range from harassing potential avian predators to keep them away from nesting areas to rare instances in which lethal control of known problem individuals is the only remaining option. To reduce the need for lethal control, a number of actions are taken to reduce the potential for predation. These actions include the installation of an electrified fence around NASA Island, placement of terra cotta tiles in the nesting area to provide some protection for chicks from avian predators, hazing of avian predators at the tern nesting colony, and placement and continual maintenance of nesting platforms in the marsh to provide safe refuge for light-footed clapper rails year-round, and particularly during the nesting season.

Predator management generally starts one month before anticipated nesting, which is about March 1 for the California least tern, and continues until all nests are fledged. Predator management surveys are conducted regularly during the nesting season and consist of routine walks around the Refuge noting tern activity, looking for evidence of potential mammalian or avian predator activity in proximity to listed species habitats (e.g., actual sightings, tracks, scat, holes or digging), inspecting the integrity of the electric fencing around NASA Island, looking for signs of any illegal public access, and checking any traps for content. Endangered species monitoring also assists the Refuge Manager in identifying potential predator problems before they elevate to the point that lethal take would be necessary. Night mammal surveys are conducted monthly on the Refuge and portions of the NWSSB. From these counts, the Refuge Manager can obtain information about the range of potential predators present in the immediate area and develop a general understanding of the number of each potential predator species that may present.

Predator control methods for predatory mammals on the Refuge include live trapping and shooting of feral cats, opossums, striped skunks, coyotes, and red fox. Manual live capture methods such as box-type mammal traps, handheld capture poles, padded leg-hold traps, or other manual techniques may be employed. All traps are inspected in accordance with State Fish and Game Code and Service policy. When suitable relocation sites or facilities are available, captured animals are transported and released to those locations. In the absence of suitable relocation sites, captured predatory animals are euthanized at the trap site. Trapped animals that do not pose a threat to listed species because of the time of year, the total estimated number of that species on the NWS, or other factors are released at the trap site or, if appropriate for the long term protection of listed species, to an area on the NWS that is well away from the marsh. Problem avian predators are generally live-captured and released at an appropriate distant off-site location. Lethal removal of predatory birds occurs in rare cases when a problem predator cannot be trapped, there is an imminent threat to endangered species, or it returns after release away from the Refuge and continues to prey on endangered species. The techniques for avian predator control are implemented in accordance with agency policies for safety and humane treatment of animals.

The common raven *(Corvus corax)* and American crow (*Corvus brachyrhynchos*) are documented predators of least tern chicks and eggs. In recent years limited numbers of ravens (three individuals in 2007) have had to be lethally removed. Another potential way to control crows and ravens is the use of DRC-1339. Although proposed for use in the approved predator management plan for this Refuge, DRC-1339 has never been used on the Refuge. DRC-1339 is a pesticide used to control corvid (i.e., crow and raven) populations. It is injected into chicken eggs, which are then secured onto strategically placed elevated bait stations in the vicinity of endangered species nesting areas. Ingestion of the pesticide is lethal to the crow or raven. Specific baiting and pre-baiting activities are conducted to eliminate the possibility of attracting non-target species.

Public Use Program

Although the Refuge Improvement Act requires that the six wildlife-dependent recreational uses of the NWRS (hunting, fishing, wildlife observation, photography, environmental education, and interpretation) receive priority consideration in refuge planning, the fact that this Refuge is located on a military weapons station necessarily limits the types of activities permitted to occur here. Currently, the Refuge provides opportunities for wildlife observation, interpretation, and environmental education.

Public Access. Public access on the Refuge is restricted to guided tours and outings in accordance with NWSSB's military mission. Currently, a public tour of the Refuge is offered once a month and special tours are periodically conducted to support the Refuge's objective of providing opportunities for wildlife observation, interpretation, and environmental education.

Wildlife Observation and Interpretation. A three-hour public walking tour of the Refuge is offered on the last Saturday of each month. Reservations must be made in advance and attendance is generally limited to 50 people. These tours, which are led by USFWS staff and the Friends of the Seal Beach NWR, are conducted in cooperation with NWSSB. Visitors enjoy videos in the visitor contact station that describe the resources on the Refuge and provide an overview of the National Wildlife Refuge System. The tours also include a visit to the native plant garden and a walk along Bolsa Avenue to an existing observation platform. Along the way, an information station is set up where visitors can learn about the aquatic organisms supported within Anaheim Bay.

A six to eight-foot-wide pedestrian pathway, consisting of compacted decomposed granite, provides access from the Refuge Headquarters east along Bolsa Avenue to an existing observation deck, located about a half of a mile east of the intersection of Bolsa Avenue and Kitts Highway. The observation deck is located on the south side of Bolsa Avenue and provides the public with views into the marsh. Spotting scopes, binoculars, and interpretive signage with information about the habitats and species protected on the Refuge are provided on the observation deck during the tours to enhance the public's experience.

Other opportunities for wildlife observation and interpretation include periodic special tours for birding groups, girl and boy scout groups, and other interested groups, as well as volunteer opportunities related to habitat restoration, weed removal, and general clean-up. These volunteer opportunities are often associated with National Public Lands Day, International Migratory Bird Day, or other state or nation-wide annual events.

Environmental Education. Special tours of the Refuge are also held for school groups of all ages. An additional Refuge-related off-site environmental education program, implemented by the Friends of Seal Beach NWR, serves about 500 students annually.

Wildlife Photography. Cameras are not permitted on NWSSB without written permission from the Navy. Occasionally, the Navy will grant permission for Refuge staff or Refuge volunteers to take photographs of Refuge resources to help promote wetland conservation and increase public awareness of the birds and habitats protected on the Refuge.

Hunting and Fishing. To avoid conflicts with the mission of NWSSB, hunting and fishing are prohibited on the Refuge.

Refuge Operations

Under this alternative, the Refuge would continue to be managed by one full-time Refuge Manager and one part-time maintenance worker. Additional assistance would be available from Refuge Complex staff.

The Refuge Headquarters, which consists of a small military building identified by NWSSB as Building Number 226, is located outside the Refuge boundary near the southwest corner of Kitts Highway and Bolsa Avenue. The building includes two small offices spaces, storage areas, a single restroom, and a moderately-sized assembly area where Refuge information and interpretive displays are provided for public viewing. Video presentations for approximately 25 people can also be accommodated in the assembly area. Just to the south of the Refuge Headquarters are small storage sheds and outdoor storage areas for Refuge equipment and tools. In addition, a native plant garden, developed and maintained by the Friends of Seal Beach NWR, is located to the north, west, and southwest of the Refuge Headquarters. An interpretive kiosk has been constructed adjacent to the Refuge Headquarters to provide visitors with additional information about the Refuge. Neither the Refuge Headquarters nor the native plant garden is located within the Refuge boundary.

Environmental Contaminants Coordination

As illustrated in Figure 3-1, the U.S. Navy owns the majority of the lands and waters included within the Refuge boundary. As a result, the Navy is responsible for the identification, assessment, characterization, and clean-up or control of contaminated sites within the Refuge, as well as throughout NWSSB. In 1985, the Navy conducted an assessment of NWSSB, which included the Refuge, and identified eight sites within the Refuge boundary (*U.S. Navy 2007b*). Of the eight sites, only three have yet to be fully remediated. For two of the sites, remediation is the responsibility of the Navy, while the third site, Oil Island, is the responsibility of the facility operator, Breitburn Energy Corporation. Chapter 4 provides further information about these sites and their remediation.

The Service's Contaminants Program is available to assist the Refuge Manager in issues related to contaminants, as well as to conduct studies related to the effects of contamination on Refuge trust resources. The Contaminants Program at the Carlsbad Fish and Wildlife Office is currently conducting a multiple-year contaminants study on the light-footed clapper rail population at the Seal Beach NWR involving analysis of blood, feathers, and nonviable eggs.

The Refuge will continue to coordinate with the NWSSB, as well as with the Service's Contaminants Program, to ensure that potential contaminants issues are appropriately addressed as part of the overall management plan for the Refuge.

Cultural Resource Management

It is the policy of the NWRS to identify, protect, and manage cultural resources located on Service lands and affected by Service undertakings for the benefit of present and future generations. The Navy, as the landowner, also has responsibilities for insuring the protection

of cultural resources within the Refuge. In accordance with its responsibilities, the Navy has initiated cultural resource surveys for various projects on NWSSB. In addition, as part of the CCP process, a Cultural Resources Review was conducted for the Refuge to provide the Refuge Manager with pertinent information about the cultural resources on the Refuge, as well as to provide guidance on how to ensure the long term protection of known and unknown cultural resources within the Refuge boundary. As a result of these surveys and reviews, all of the areas within the Refuge that are accessible have been surveyed for archaeological resources. The Refuge's inaccessible wetlands have not been surveyed.

Because there is the potential for undiscovered cultural resources to be present beneath the surface within previously surveyed and yet to be surveyed areas within the Refuge, any ground disturbing activities proposed within the Refuge boundary are reviewed by the Service's Cultural Resources Program for compliance with Section 106 of the Historic Preservation Act. The review process involves the preparation of a Request for Cultural Resources Compliance which is submitted to the Regional Cultural Resources Office for review. With information about the project location and extent of the proposed ground-disturbing activity, the Cultural Resources Office will determine the potential effect of the proposal on cultural resources. Those projects that would result in only minor impacts to subsurface materials could fall under the Service's programmatic agreement with SHPO, while other projects requiring greater ground disturbance would require SHPO review and concurrence.

Volunteers and Partners

The Friends of Seal Beach NWR are an essential part of the Refuge management team. Consisting of local citizen volunteers, the Friends devote thousands of hours each year to habitat restoration, endangered species monitoring, environmental education programs, public outreach, and much more. Without assistance from the Friends, it would not be possible to implement the monthly public tours of the Refuge or conduct special tours and other public events that allow the public to enjoy the wildlife and habitats protected within the Refuge. This group of dedicated individuals has been involved in the stewardship of the Refuge for several decades. It is through their efforts that the Service is able to spread the word about the Seal Beach NWR.

As described above, the Navy is also an important partner in the management of the Refuge, providing oversight of some issues, providing funding to assist in various aspects of wildlife and habitat management, and assisting in the Refuge's visitor program. Other partners include local universities, whose students conduct research on the Refuge; local agencies that assist in mosquito control and storm water management; and state and federal agencies, such as the California Department of Fish and Game and the National Marine Fisheries Service, that coordinate with the Refuge Manager on issues affecting coastal southern California resources.

Mosquito Monitoring and Control

The Orange County Vector Control District (OCVCD) is responsible for monitoring and controlling mosquitoes on the Refuge and adjacent Navy lands. On the Refuge, these activities are conducted in accordance with a Special Use Permit (SUP) and approved Pesticide Use Proposals (PUPs), both of which are prepared on an annual basis. The SUP permits OCVCD to control populations of mosquitoes at selected locations on Refuge for the purpose of protecting human and wildlife health and safety. Locations currently approved for mosquito monitoring and control are indicated in Figure 3-3. The SUP states that mosquito control shall rely on the use of physical and biological control as much as practicable prior to using chemical

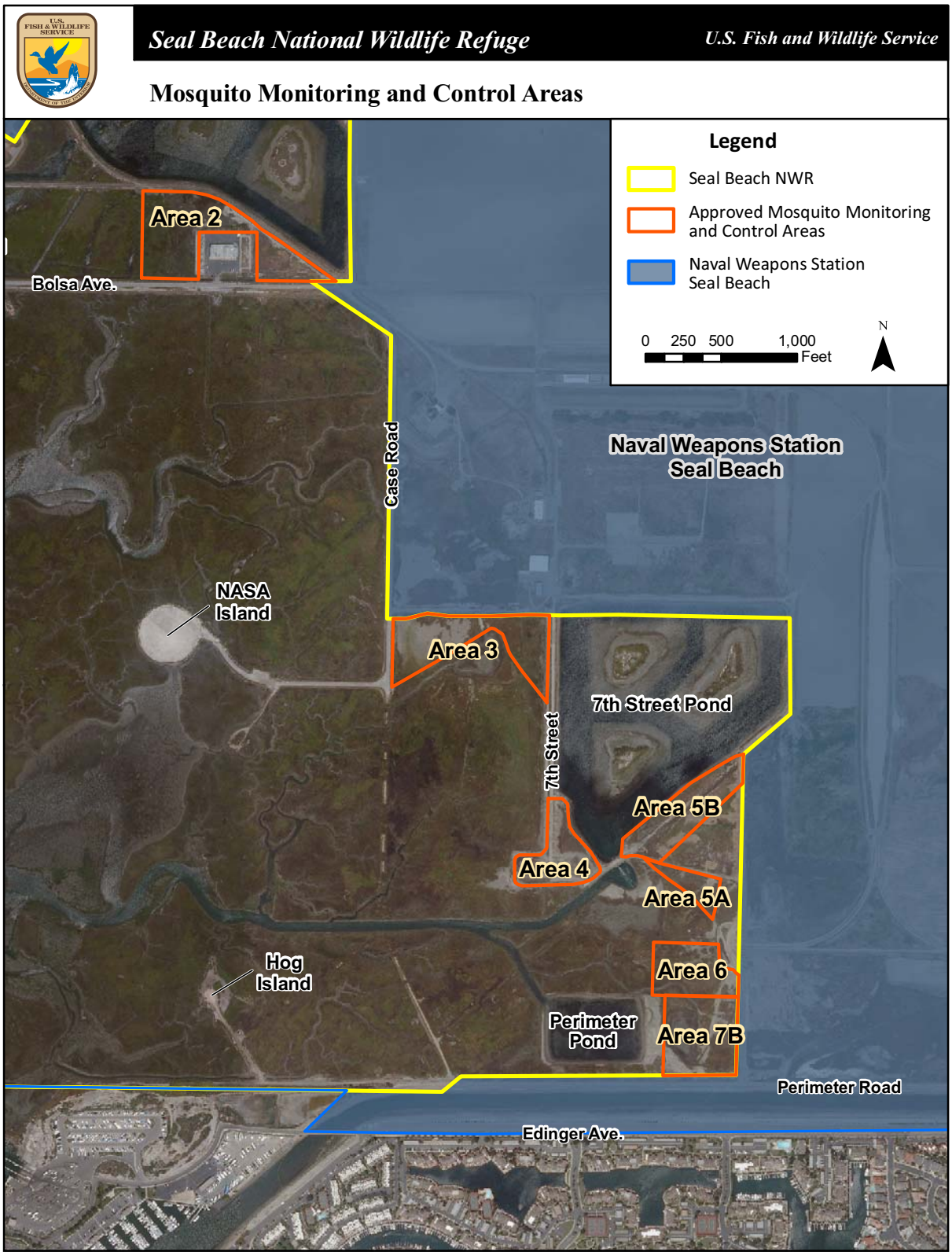

Figure 3-3. Approved Mosquito Monitoring and Control Areas on the Seal Beach National Wildlife Refuge

larvicides. Larvicides approved for use on the Refuge include *Bacillus thuringienensis* var. *israelensis* (Bti), *Bacillus sphaericus* (Bs), and Altosid®. Bti and Bs, both naturally occurring soil bacteria, are used to control mosquitoes in wetlands prior to their emergence as adults.

Altosid® is a trade name for methoprene, an insect development regulator used in the control of mosquitoes. Methoprene is considered a biochemical pesticide because rather than controlling target pests through direct toxicity, it interferes with an insect's life cycle by mimicking a growth hormone found in mosquitoes that prevents the mosquito from reaching maturity or reproducing (*USEPA 2001*).

The special conditions of the SUP include: coordinate all activities with the Refuge Manager at least two business days prior to entry onto the Refuge or provide the Refuge Manager with a schedule of seasonal activities prior to the beginning of the mosquito season; limit activities to approved locations on the Refuge; enter approved locations by foot only; report any pesticide application within one week of application; and adhere to U.S. Environmental Protection Agency (USEPA) application regulations.

3.4.3.2 Alternative B - Maximize Salt Marsh Restoration, Continue Current Public Uses

Under Alternative B (Figure 3-4), the wildlife and habitat management activities described in Alternative A would be expanded to include new activities intended to: protect and aid in the recovery of the light-footed clapper rail and California least tern; increase our understanding of the array of species present within the Refuge and their relationship with other species and existing habitats; broaden our understanding of how the Refuge's trust resources are being affected by climate change and sea level rise; and restore the remaining disturbed habitat areas on the Refuge to functional salt marsh and wetland/upland transition habitat. No changes to the public use program described in Alternative A are proposed.

Wildlife and Habitat Management

In addition to the wildlife and habitat management activities described under Alternative A, including predator management, the following new or expanded actions would also be implemented under this alternative:

Endangered Species Management. Management of the light-footed clapper rail under this alternative would be expanded to include developing a greater understanding of the habitat qualities and species dynamics present in the natural rail nesting areas located between Hog Island and Perimeter Pond. Efforts would be made to encourage research projects that: 1) identify the factors that appear to favor natural nesting in this area; 2) compare the fledgling success rates in these natural areas to fledgling success on nesting platforms; and 3) explore various options for improving habitat quality in other parts of the marsh in part to increase opportunities for natural nest sites on the Refuge.

In an effort to reduce avian predation of rails and least terns, the Refuge Manager would work with the NWSSB to reduce perching opportunities around the marsh. Potential actions could range from installing anti-perching materials on existing power poles and rooftops to relocating the existing poles well away from the marsh.

Integrated Pest Management. Under Alternative B, an Integrated Pest Management (IPM) Plan (Appendix C) would be implemented for the Refuge. In accordance with 517 DM 1 and 569 FW 1, an IPM approach would be utilized, where practicable, to eradicate, control, or contain pest and invasive species (herein collectively referred to as pests) on the Refuge.

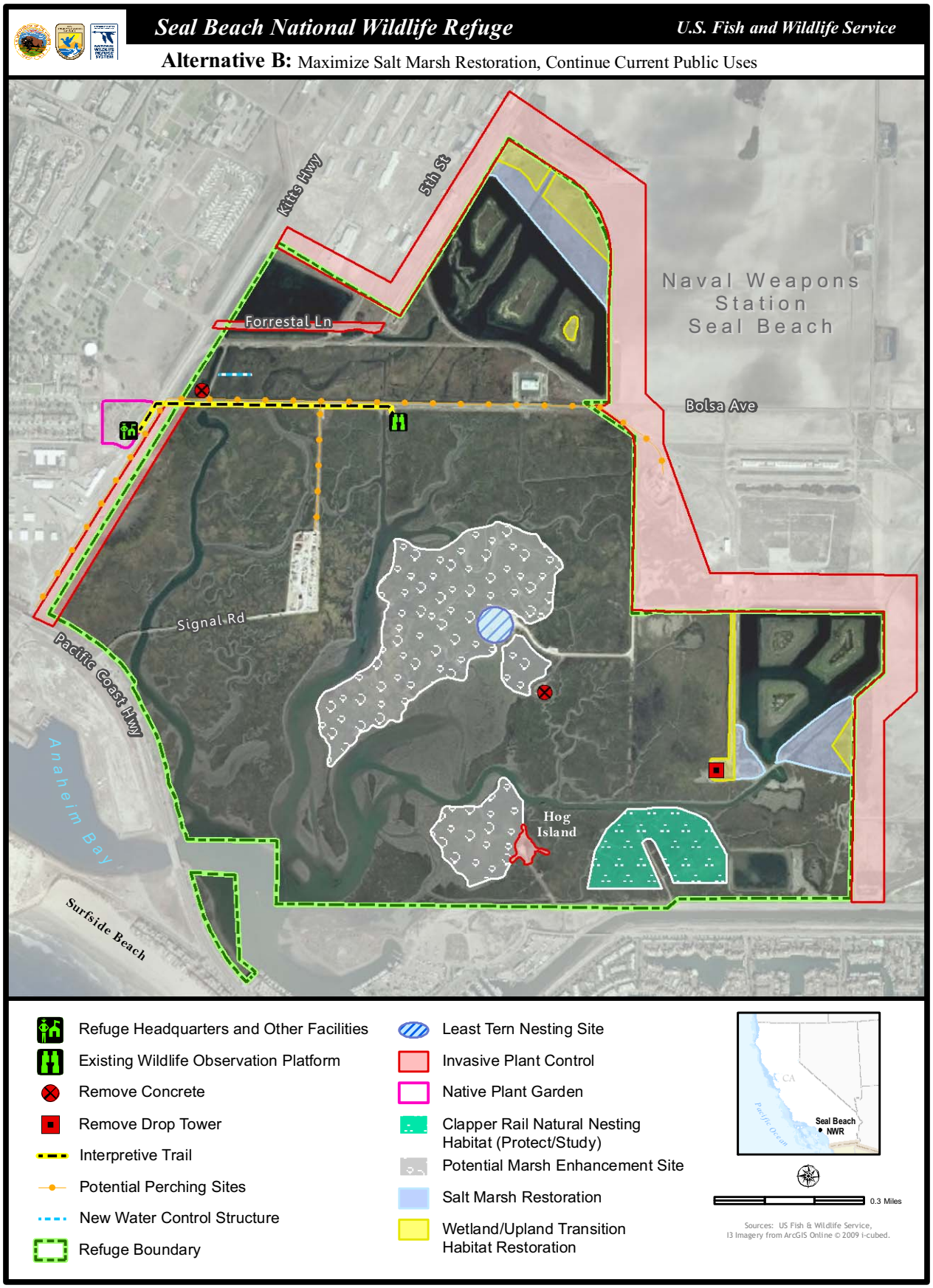

Figure 3-4. Alternative B

Implementing the IPM Plan would involve using methods based upon effectiveness, cost, and minimal ecological disruption, which considers minimum potential effects to non-target species and the refuge environment.

Under the IPM Plan, pesticides may be used where physical, cultural, and biological methods or combinations thereof, are impractical or incapable of providing adequate control, eradication, or containment. If a pesticide is necessary for use on the Refuge, the most specific (selective) chemical available for the target species would be used unless considerations of persistence or other environmental and/or biotic hazards would preclude it. In accordance with 517 DM 1, pesticide usage would be further restricted because only pesticides registered with the USEPA in full compliance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and as provided in regulations, orders, or permits issued by USEPA may be applied on lands and waters under refuge jurisdiction. The types of pesticides that can be used on the Seal Beach NWR are also limited to those products available for sale in the State of California. Before a pesticide product can be sold or offered for sale in California, is must be approved and registered by the State's Department of Pesticide Regulation.

Environmental harm by pest species would refer to a biologically substantial decrease in environmental quality as indicated by a variety of potential factors including declines in native species populations or communities, degraded habitat quality or long-term habitat loss, and/or altered ecological processes. Environmental harm may be a result of direct effects of pests on native species including preying and feeding on them; causing or vectoring diseases; preventing them from reproducing or killing their young; out-competing them for food, nutrients, light, nest sites or other vital resources; or hybridizing with them so frequently that within a few generations, few if any truly native individuals remain. Environmental harm also can be the result of an indirect effect of pest species. For example, decreases in native pollinator diversity and abundance may result from invasive plant infestations that reduce the availability and/or abundance of native upland plants that support native pollinator species.

Environmental harm may involve detrimental changes in ecological processes. For example, invasive nonnative plant species can outcompete and ultimately replace native species of forbs and shrubs, altering the function of the historic plant community. Environmental harm may also cause or be associated with economic losses and damage to human, plant, and animal health. For example, invasions by fire-promoting nonnative grasses that alter entire plant and animal communities can also increase the frequency and intensity of wild fires, which in turn increases fire-fighting costs and threats to adjacent developments.

The IPM Plan proposed for implementation on the Seal Beach NWR is provided in Appendix C. Along with a more detailed discussion of IPM techniques, this documentation describes the selective use of pesticides for pest management on the Refuge, where necessary. Throughout the life of the CCP, with the exception of mosquito-related pesticides, all pesticides proposed for use on the Refuge would be evaluated by the IPM Regional Coordinator for potential effects to refuge biological resources and environmental quality. The results of this evaluation, including the potential effects of each product, would be documented in "Chemical Profiles." Chemical profiles have already been completed for those pesticides that are currently being used on the Refuge and are available for review in Attachment B of Appendix C. Only those pesticides that are likely to result in only minor, temporary, and/or localized effects to species and environmental quality based upon non-exceedance of threshold values in Chemical Profiles would be approved for use on the Refuge. In all cases, best management practices would be implemented during the handling and application of pesticides, and in some cases, non-exceedance of threshold values may be achieved through the implementation of additional

BMPs that further define how, when, where, and to what extent a specific pesticide may be applied.

As described under Alternative A, pesticide use on the Refuge also conforms to the requirements of the Navy's approved Integrated Pest Management Plan for NWSSB, which requires that all pesticides used on the Refuge be approved by the Navy prior to initial use. Additionally, the details of pesticide application on the Refuge are documented on the Navy On-line Pesticide Reporting System.

Mosquito Management Plan. Under this alternative, mosquito management implemented on the Refuge by the OCVCD would have to conform to the management approach included in the Refuge's Mosquito Management Plan (Appendix D). This plan presents a phased approach to mosquito monitoring and control on the Refuge. These phases are summarized below and described in detail in Appendix D.

Phase 1. In Phase 1, mosquitoes are known to breed on the Refuge, but mosquito threshold treatment levels on the Refuge have not been exceeded during the current breeding season. Under these conditions, mosquito monitoring would be implemented throughout the breeding season, but no mosquito control would be conducted. Mosquito monitoring would be conducted consistent with current practices, as described under Alternative A.

Phase 2. In Phase 2, the control mosquito larvae would be permitted on the Refuge when mosquito breeding is documented on the Refuge and the numbers of mosquito larvae present exceed OCVCD's mosquito larvae threshold treatment levels. The criteria used by OCVCD (*2010*) to determine when treatment to control mosquito larvae should be considered are presented in Table 3-2.

Table 3-2
OCVCD Criteria for Considering Pesticide Application to Control Immature Mosquito Populations

Mosquito Species	Criteria for Considering Treatment
Anopheles spp.	≥ 2 immatures/40 dips
Culex spp.	≥ 2 immatures/20 dips
Aedes spp.[1]	≥ 2 immatures/10 dips
Culiseta spp.	≥ 2 immatures/10 dips

Source: (*Orange County Vector Control District 2010*)
[1] *Aedes* is currently the only genus of mosquito known to breed on the Refuge.

In this phase, mosquito monitoring would be implemented throughout the breeding season, actions to reduce potential mosquito breeding habitat on the Refuge would be conducted per available funding, and the Refuge Manager may allow compatible mosquito larvae control when the numbers of immature mosquitoes present in an area exceed the threshold criteria presented in Table 1. In addition, mosquito monitoring on the Refuge would be expanded to include an evaluation of the effectiveness of the mosquito control measures being implemented to control mosquito larvae populations on the Refuge.

Phase 3. In Phase 3, mosquitoes are known to breed on the Refuge; the numbers of mosquito larvae in the later instar stages and/or pupae present on the Refuge have

exceeded established mosquito threshold treatment levels (Table 1); and the species of mosquitoes breeding on the Refuge pose an immediate threat to human health. Based on these criteria, the actions that would occur under Phase 3 include: mosquito monitoring throughout the breeding season; actions to reduce potential mosquito breeding habitat on the Refuge per available funding; and treatment of mosquito larvae and pupae that is compatible with Refuge purposes.

Phase 4. Phase 4 of the Mosquito Management Plan would include the use of an adulticide to control mosquito populations on the Refuge. The following conditions must be met before an adulticide could be applied on the Refuge:

- A public health emergency has been declared by the Orange County Health Care Agency (OCHCA) or the California Department of Public Health for an area that includes the Refuge;
- Infected mosquitoes have been identified on the Refuge or infected mosquitoes of the species known to breed on the Refuge have been identified within the published flight range of mosquito breeding areas on the Refuge;
- The criteria established in the OCVCD's Integrated Vector Management and Response Plan (*OCVCD 2010*) for determining when treatment of adult populations of mosquitoes (Table 3-3) should be considered has been exceeded on the Refuge for the mosquito species of concern;
- The FWS Integrated Pest Management Coordinator has approved the adulticide proposed for use through the PUPs review process; and
- The SUP issued to OCVCD has been modified by Refuge Manager to address adulticide application.
- OCVCD has coordinated with the Refuge Manager and Navy Environmental Office staff on how, when, and where an adulticide would be applied on the Refuge.

Table 3-3
OCVCD Criteria for Considering Adulticide Application

Mosquito Species	Criteria for Considering Treatment
Culex spp.	25 or more females per collection per trap night
Anopheles spp.	25 or more females per collection per trap night
Aedes spp.[1]	5 or more females per collection per trap night[2]
Culiseta spp.	10 or more females per collection per trap night
Multiple species	25 or more total female mosquitoes per collection per trap night

Source: (*Orange County Vector Control District 2010*)

[1] *Aedes* is currently the only genus of mosquito known to breed on the Refuge.

[2] The total number of trapped females is lower for Aedes spp. than other species of mosquitoes because Aedes spp. demonstrated a limited attraction to CO_2 traps. New types of traps are currently being considered by OCVCD to more accurately establish populations of Aedes spp. in Orange County (Jim Green pers. comm.).

To reduce the potential for additional applications of adulticide within a season, all adulticide application shall occur in conjunction with the application of larvicides and pupacides. In addition, adulticides shall only be applied using vehicle mounted or backpack fitted ultra-low volume spray equipment and applications shall only occur along those roads that extend along the northern, eastern, and western perimeter of the Refuge and only when meteorological conditions are stable and favorable with a consistent wind

greater than three miles per hour from the south or southwest. No aerial spraying over the Refuge would be permitted. OCVCD shall also coordinate with the Refuge Manager and NWSSB prior to applying any adulticides, as well as during the monitoring and evaluation of the effectiveness of the treatment in eliminating the threat to human health.

Under Alternative B, the following mosquito control products would be considered for use under appropriate condition: the larvicides *Bacillus thuringiensis* var. *israelensis* (Bti), *Bacillus sphaericus* (Bs), Altosid, and Natular™; the pupacide, monomolecular biodegradable film (e.g., Agnique MMF); and adulticides with the active ingredient sumithrin (e.g., Anvil 10+10 ULV, AquaAnvil™).

Other Management Activities. Other management actions proposed under this alternative to benefit listed species, as well as the other trust species supported by the Refuge include:

1. Replacement of the Western Culverts in the Bolsa Cell
   Two 30-inch culverts were installed within the western levee of the Bolsa Cell as part of the Port of Long Beach restoration project (refer to Section 4.2.5.1 for more information). These culverts, which facilitate the flow of bay water into the western end of the cell, have over the years been plugged to reduce the volume of water entering the cell and then subsequently reopened in an attempt to better regulate water levels, all with limited degrees of success. The existing culverts are in poor condition, with significant signs of deterioration. Tidal flow through the culverts has been severely compromised by mussel fouling, while pipe erosion is allowing water to flow around the culvert, threatening the stability of the levee. Under this alternative, the culverts would be removed, the levee repaired, and a new water control structure installed near the center of the levee.

   The preliminary design for the water control structure indicates that the structure would likely consist of pre-cast concrete headwalls and tail walls, a stainless steel slide/screw gate, and two 30-inch diameter, 40-foot-long High Density Polyethylene (HDPE) pipe, which is highly resistant to biological buildup (e.g., mussel fouling) and is not susceptible to corrosion. The incorporation of a slide/screw gate into the design would allow for the precise management of tidal flows into and out of the Bolsa Cell. Although the specific design of the structure could change during final design, the general way in which the structure would be operated would remain the same.

   Installation of the new structure would require the use of coffer dams, or the implementation of other appropriate actions, during construction to prevent tidal exchange through the construction site. The tide gate structure would be placed on base rock and then back filled with appropriate clean material. Once the areas around the concrete headwalls and tailwalls are back filled and properly compacted, rip-rap would be placed around the structure to prevent any erosion of the back fill material.

   Following installation and testing of the new water control structure, the old culverts would be removed and this portion of the levee would be filled and stabilized with the rip-rap. Installation of the new structure, culvert removal, and levee stabilization would be implemented using a conventional land excavator. Debris and any excess fill from the project would be trucked away for disposal at an appropriate off-site location. All work would be conducted between September 1 and February 1 to avoid impacts to nesting birds and best management practices would be implemented to protect water quality and native habitat.

Once all construction and site cleanup has been accomplished, the top of the levee would be planted with appropriate native wetland/upland transitional and upland vegetation. In addition to NEPA, which is addressed through this document, this project will also be required to comply with the requirements of the Clean Water Act, the Endangered Species Act, Section 106 of the Historic Preservation Act, and the Coastal Management Act.

2. Removal of Concrete and Debris from the Marsh
   Old concrete and other miscellaneous debris can be found in various locations throughout the marsh complex. Under this alternative, this debris would be removed and the area restored to native vegetation. Removal would likely require the use of an excavator, although some debris may be removed with a crane. To the extent feasible, heavy equipment used to remove the debris would remain on adjacent roads to reduce the potential for impacts to sensitive habitat. Where appropriate, such as in higher marsh areas or areas expected to support wetland/upland transitional habitat, locally native plants would be installed to ensure appropriate native plant species diversity. This alternative also proposes to work with NWSSB to remove the abandoned structure located on Hog Island. Activities associated with the removal of this structure would occur on existing roads and/or in disturbed upland areas. Activities would be restricted to the period between September 1 and February 1.

3. Invasive Plant Control Beyond the Refuge Boundary
   To reduce the spread of non-native weeds on Refuge lands, this alternative includes a proposal to seek Service and/or grant funding that would enable NWSSB to implement an invasive plant control project for the upland areas located outside the Refuge along the perimeter of the Refuge boundary. The Refuge would also assist the NWSSB in identifying potential funding sources to support regular monitoring in the harbor and marsh for the invasive marine algae, *Caulerpa taxifoli*. If this species is located during monitoring, immediate actions would be taken to contain and eradicate it before it becomes established.

4. Document the Health of the Refuge's Cordgrass Habitat
   High quality cordgrass habitat is important to the light-footed clapper rail population on the Refuge. For reasons that have not yet been analyzed, the quality of the cordgrass habitat on the Refuge is not optimal. Therefore, under this alternative, funding and partnerships would be sought to develop and implement a study to describe the current health of the cordgrass stands within the Refuge; identify those factors that could be inhibiting optimum plant health, density, and height; and develop strategies for improving the overall health of the cordgrass habitat, if necessary.

5. Implement Directed Surveys for Tiger Beetles
   Several tiger beetle species have been identified on the Refuge, particularly in salt pan areas; however, a directed survey to provide baseline data for tiger beetle diversity and abundance on the Refuge has never been conducted. Under this alternative, funding and partnerships would be sought to implement a directed search for tiger beetles. Special emphasis would be placed on identifying any habitat areas that support tiger beetle species such as Gabb's tiger beetle (*Cicindela gabbii*) and Frost's tiger beetle (*Cicindela senilis frosti*), which have been identified by the state as highly imperiled, (*CDFG 2008*).

6. Increase Efforts to Inventory Refuge Species
   Baseline data for avian species diversity and abundance are well established for the Seal Beach NWR and baseline data is also available for fish species presence in Anaheim Bay. Significantly less information is currently available for native plant species, other vertebrate, and invertebrate species that occur on the Refuge. To expand the information available for the array of species present within the Refuge and their relationship to other species and existing habitats, this alternative proposes to expand and/or update the existing biological baseline information for the Refuge by locating and compiling historic monitoring and/or survey data and seeking funding and/or developing partnerships to implement periodic (every three to five years) surveys for the array of organisms supported on the Refuge.

7. Implement a Five-Year Water Quality Monitoring Program
   Funding and/or partnerships would be sought to implement a five-year water quality monitoring program on the Refuge to regularly collect data on the basic physical parameters of the waters within the Refuge, including water temperature, dissolved oxygen, water salinity, pH, light attenuation, turbidity, and levels of inorganic nitrogen and phosphorus. This program would also include first flush monitoring of runoff entering the Refuge from adjacent drainage channels, as well as regular quarterly monitoring at pre-designated tide cycles and sample locations throughout the Refuge.

8. Monitor Tidal Channel Bathymetry and Channel Bank Stability
   The slopes along major tidal channels and around the perimeter of the restoration ponds would be photographed to establish a baseline from which the effects of ongoing erosion in these areas can be assessed. These areas would then be photographed and evaluated annually at similar tide cycles to determine if remediation is necessary to protect natural marsh edges for shorebird foraging and as refugia for migratory birds during high tides. An initial bathymetric survey of the main tidal channels in the marsh would also be conducted to establish baseline channel depths. This survey would be repeated every three to five years to determine what, if any, changes in channel bathymetry are occurring.

9. Expand Opportunities for Research on the Refuge
   During the scoping process, the need for research and associated studies of the species and biological processes occurring on the Refuge was identified. To address this need, the Refuge would reach out to various graduate programs to seek researchers interested in addressing research questions that benefit Refuge resources and improve management effectiveness.

10. Monitor Changes Related to Climate Change and Sea Level Rise
    To better understand how the Refuge's trust resources are being affected by climate change and sea level rise, funding and/or partnerships would be sought to facilitate routine monitoring and recording of tidal elevations within the marsh and changes in habitat quality and type over time. Changes in avian species composition would be determined by comparing monthly high and low tide counts with data provided from previous years. Additionally, periodic (every five to ten years) fish surveys would be conducted to compare current conditions to those documented in comprehensive surveys conducted in past years. Data from endangered species monitoring would also be analyzed to identify any potential change in site use, species population sizes, productivity, and other relevant factors that might be associated with climate change and/or sea level rise. Understanding how conditions are changing as a result of climate

change and sea level rise would assist the Refuge Manager in making necessary changes in ongoing management strategies to ensure that Refuge goals and purposes can continue to be achieved.

11. Improve the Quality of Runoff Entering the Marsh
Refuge staff would coordinate with other federal, state, and local agencies to identify actions and policies that when implemented would lead to improvements in the quality of the water entering the marsh from upstream sources. Through a multi-agency partnership, funding would be sought to design and implement specific projects on or off the Refuge to reduce the level of pollutants at the source and throughout the flood control system, including within the Bolsa Chica and East Garden Grove-Wintersburg flood control channels, both of which empty into Anaheim Bay.

Habitat Restoration

There are several opportunities for habitat restoration within the Refuge. Approximately 37 acres of disturbed upland have been identified as future restoration sites including: 22 acres located to the north of Case Road Pond; approximately one acre on the eastern-most island in the Case Road Pond; nine acres to the southeast of 7th Street Pond; and five acres located along the western edge of 7th Street Pond and around the existing drop tower at the southern end of 7th Street. These areas and the habitat types proposed for each site are presented in Figure 3-4. Table 3-4 provides a breakdown of proposed habitat acreages per location.

These restoration proposals could be implemented under one project proposal, or the restoration could be phased over a number of years. The extent and timing of when various restoration proposals are implemented would be dependent upon the level of funding that is secured to implement restoration. The overall cost of implementing the restoration proposals would be lower if all of the sites could be restored as part of single project, but this option may not be feasible based on the limited availability of funding sources for restoration. It is the intent of this document to fulfill the NEPA requirements for future implementation of these restoration proposals. Once the final restoration plans are completed, the project(s) will be reviewed for consistency with the analysis provided in this document. If consistent, no further actions related to NEPA will be necessary. Future restoration projects will however be required to comply with the requirements of the Clean Water Act, the Endangered Species Act, Section 106 of the Historic Preservation Act, and the Coastal Management Act.

Table 3-4
Habitat Restoration Proposals for Alternative B

Area	Area (acres)	Habitat to be Restored
Northern portion of Case Road Pond site	9	Wetland/upland transition
Southern portion of Case Road Pond site	12	Intertidal salt marsh and mudflat
Eastern-most island in the Case Road Pond	1	Wetland/upland transition
Triangle-shaped area to southeast of 7th Street Pond	2	Wetland/upland transition
Boomerang-shaped area to southeast of 7th Street Pond	8	Intertidal salt marsh and mudflat
Area at southwestern tip of 7th Street Pond and east of the drop tower	2	Intertidal salt marsh and mudflat
Strip of land to the west of 7th Street Pond and square area in vicinity of drop tower	3	Wetland/upland transition

The upland areas to the north of Case Road Pond and to the southeast of 7th Street Pond were created in the 1920s when four to five feet of fill material was deposited into the historic marsh to create farmland. At present, these areas, as well as the upland area to the east of 7th Street Pond, are dominated by non-native, invasive upland plants. Restoration of these areas would involve the removal of fill material to achieve elevations supportive of type of habitat proposed for each site. The Case Road site, the area to the southeast of 7th Street Pond, and the area to the east of the drop tower would under this alternative be restored to a range of subtidal, intertidal mudflat, salt marsh, and wetland/upland transitional habitat, while the berm to the west of 7th Street and west of the drop tower would be restored to wetland/upland transitional habitat (refer to Figure 3-4). Conventional land excavators, motor graders, and dump trucks would be used to achieve the desired elevations and excess material would be removed to an appropriate location either on or off the Refuge.

The salt marsh restoration sites near Case Road and 7th Street would be designed and constructed to include meandering subtidal channels that would extend from the existing edge of the subtidal habitat through the range of salt marsh zones (i.e., low, middle, high) that would be created. The channels would be constructed to include broad side slopes to support increased habitat diversity. Once the desired elevations have been achieved within the restoration sites, native plants appropriate to the range of elevations present at each site would be installed to supplement natural species recruitment. Areas proposed for wetland/upland transitional habitat would require the greatest density of installed plant material. To the extent practicable, cuttings and other vegetative matter, as well as plants sprouted from seeds collected within the Refuge's existing wetland habitats, would be used to vegetate the salt marsh and transition habitat areas.

Before salt marsh restoration could occur on the 7th Street sites, four inactive water monitoring wells would have to be removed from the area to the southeast of the pond and the Navy would have to agree to have the small bunkers removed from the area located to the west of the pond. Elimination of the wells would involve removing the well casing to below the elevations of the future restoration project and then either filling the remaining well with sand and installing a concrete cap or filling the well entirely with concrete. Removal of the wells would require compliance with applicable County of Orange regulations. Removal of the bunkers would generate additional material for offsite disposal.

Restoration of the eastern-most island in the Case Road Pond would involve the removal of the invasive weeds from the tops of the four highest mounds on the island and the installation of appropriate native wetland/upland transition species.

The installation of wetland/upland vegetation would begin in the fall when temperatures are cooler and the likelihood for precipitation is higher. The plant species to be installed would include alkali heath (*Frankenia grandifolia*), estuary seablite (*Suaeda esteroa*), alkali weed (*Cressa truxillensis*), salt grass (*Distichlis spicata*), sea lavender (*Limonium californicum*), and shore grass (*Monanthochloe littoralis*). Soil amendments and moisture gel packs would be provided when the plants are installed. If sufficient natural rainfall does not occur during the first three months after planting, additional moisture gel packs would be provided to ensure successful plant establishment.

In addition to the restoration sites described above, other areas of upland on the Refuge including areas located adjacent to pathways, along the edges of existing wetland areas, and beyond the shoulder of existing roadways would be planted with native upland species following invasive plant removal. This would reduce the potential for reinvasion of the area by

nonnative plants, expand habitat for native wildlife, and minimize the potential for erosion. A typical species list for such plantings would include: flat-top or California buckwheat (*Eriogonum fasciculatum*), California sagebrush (*Artemisia californica*), lemonade berry (*Rhus integrifolia*), broom baccharis (*Baccharis sarothroides*), coyote brush (*Baccharis pilularis*), California encelia (*Encelia californica*), white sage (*Salvia apiana*), and coastal goldenbush (*Isocoma menziesii*).

Public Use Program

No changes to the current public use program, as described under Alternative A, are proposed.

Refuge Operations

Under Alternative B, Refuge operations would include the construction of a maintenance storage building and new public restroom. These facilities would be constructed once funding is identified and the projects have been reviewed and approved by NWSSB. Both facilities would be constructed outside of the Refuge boundary adjacent to the existing Refuge Headquarters, located near the southwest corner of Kitts Highway and Bolsa Avenue (refer to Figure 3-3). This proposal does not require an expansion of the Refuge boundary. With Navy approval, these facilities can be constructed on Navy land and would be used to serve management and public use activities occurring on the adjacent Refuge. Additional details regarding these two facilities are provided below.

Maintenance Storage Building. Currently, most of the Refuge tools and equipment are stored is three small sheds located adjacent to the existing Refuge Headquarters. Due to the lack of adequate storage space, some tools and equipment are also being stored in outdoor areas located adjacent to the sheds. Refuge vehicles must be stored outdoors, where they are subject to wire damage from rodents and rabbits. Maintenance work must also be conducted outdoors. To address these storage and maintenance problems, this alternative proposes the construction of a maintenance storage building on disturbed land to the south of the Refuge Headquarters. The approximately 3,000-square-foot building would include three vehicle bays to house a gator, small riding mower, and two passenger vehicles. The building would also provide storage space for tools and equipment, a work area and small office for a maintenance worker, and a restroom facility with a shower.

Public Restroom Facility. The existing restroom facility in the Refuge Headquarters only has the capacity to accommodate one person at a time. This facility is woefully inadequate for meeting the needs of the public during monthly and special guided tours of the Refuge. To improve the visitor experience on the Refuge, this alternative includes a proposal to construction additional permanent male and female restrooms to accommodate the current need. This restroom facility, which would be constructed using green technologies to reduce water use and energy, would most likely be provided in a detached building placed on the north side of the Refuge Headquarters.

Environmental Contaminants Coordination

Environmental contaminants coordination would continue as described in Alternative A.

Cultural Resource Management

Although cultural resource management would continue to be implemented as described in Alternative A, this alternative also proposes to provide opportunities for archaeological and historical research on the Refuge. Potential research topics might include: the effects of changes in the paleoenvironment on prehistoric people in the area of the Refuge; the prehistoric occupation patterns on the Refuge's historic upland areas; the identification of

Native American subsistence and settlement patterns in and around the Refuge; and coastal and inland trading patterns.

Volunteers and Partners
Support for the Friends of Seal Beach NWR and coordination with the Refuge's other partners, including NWSSB, would continue as described in Alternative A.

3.4.3.3 Alternative C (Proposed Action) - Optimize Upland/Wetland Restoration, Improve Opportunities for Wildlife Observation

All of the management activities described in Alternative A, as well as the additional habitat and wildlife management actions described in Alternative B, with the exception of Alternative B's habitat restoration proposals, would also be implemented under Alternative C (Figure 3-5). The primary differences between Alternative B and Alternative C involve a few additional wildlife and habitat management actions; enhancement of light-footed clapper rail habitat; a greater focus on the restoration of upland and wetland/upland transition habitat; and the expansion of existing opportunities for wildlife observation.

Wildlife and Habitat Management
In addition to the actions described under Alternative B, the following additional actions would be implemented under Alternative C:

1. Management of Habitat to Support Tiger Beetles
   In addition to conducting directed surveys for tiger beetles, as proposed under Alternative B, Alternative C proposes to seek funding and/or partnerships that would facilitate the preparation and implementation of a tiger beetle management plan. The Plan would identify measures for protecting, maintaining, and if necessary, enhancing habitat to protect current tiger beetle abundance and diversity on the Refuge.

2. Establish Salt Marsh Bird's-Beak on the Refuge
   As part of restoration planning for the Case Road Pond restoration site, potential sites for the establishment of one or more populations of the Federally listed endangered plant, salt marsh bird's-beak, would be evaluated, and if appropriate locations are identified in this area, salt marsh bird's-beak seeds would be planted as part of the restoration project. The site would then be monitored for successful germination and plant development. If seeding is successful and plants produce flowers and set seeds, the site would be monitored annually to record the size and quality of the population at each site. Other potential establishment sites would be evaluated along the eastern edge of Kitts Highway to the south of Bolsa Avenue and on the south side of Bolsa Avenue just south of the interpretive trail.

3. Enhancement of Light-footed Clapper Rail Habitat
   Management of the light-footed clapper rail would be expanded to include an analysis of the extent to which the existing habitat quality within the salt marsh complex supports natural clapper rail nesting activities. Based on this analysis, strategies for improving habitat quality for nesting rails through the marsh complex would be developed, and as specific strategies are implemented, monitoring would be conducted to determine their effectiveness in supporting rail nesting and improving rail productivity. This proposal for enhancing light-footed clapper rail habitat would be further developed as part of a step-down habitat management plan for the Refuge.

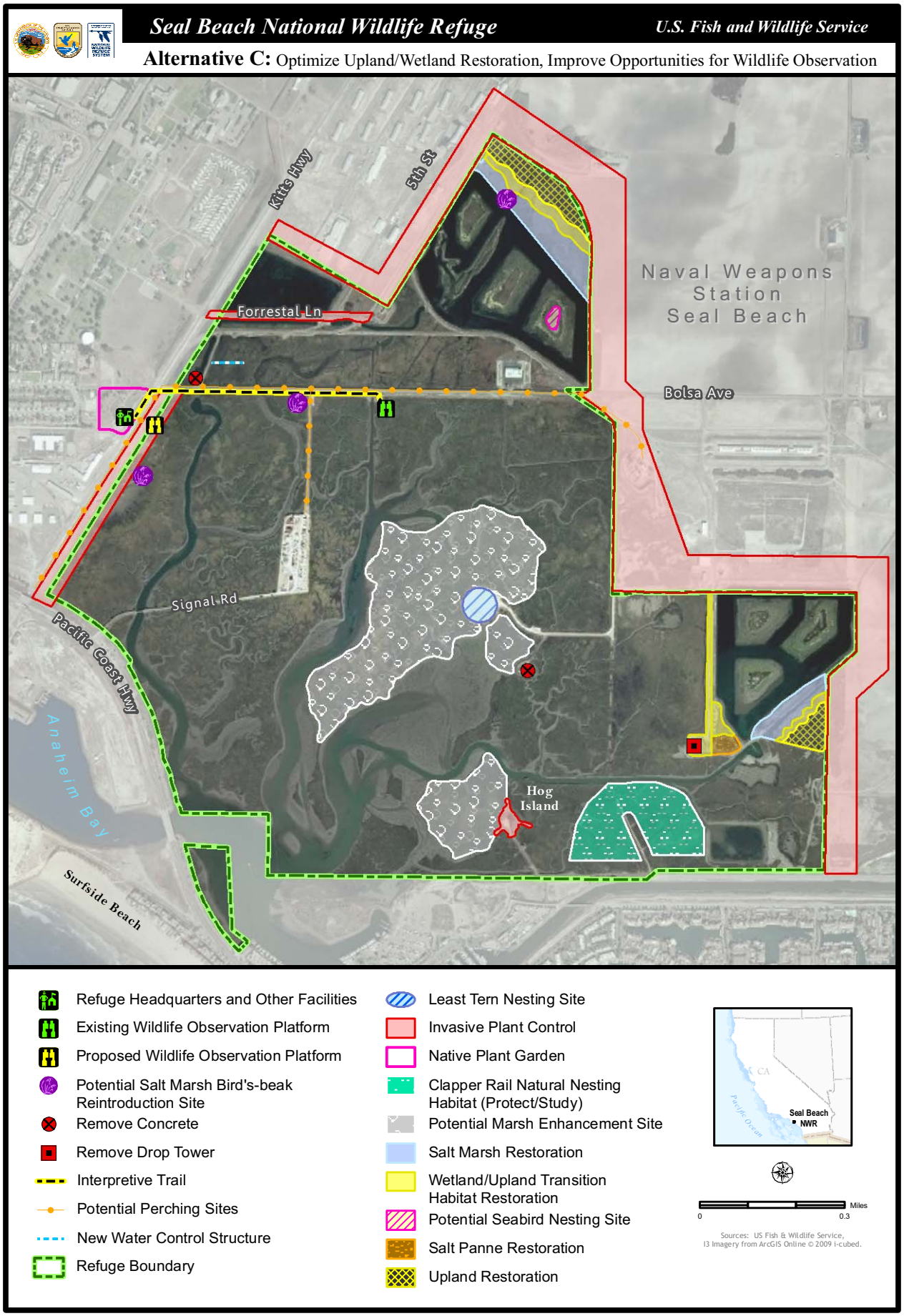

Figure 3-5. Alternative C

One proposal that would likely be evaluated as part of this step-down planning process is the pumping of sediment of appropriate grain size and nutrient content over a portion of the marsh (refer to Figure 3-4) to raise the elevation of the marsh plain in response to subsidence and sea level rise. Enough sediment would be distributed over the existing vegetation to provide for a slight increase in the elevation of the marsh plain, while still enabling the vegetation to grow up through the added sediment. Pre- and post-project monitoring would be conducted to identify any changes in cordgrass height and vitality, clapper rail use of the area for foraging, and clapper rail use of the area for nesting, as well as other factors.

4. Removal of the Drop Tower
   Under this alternative, the drop tower located at the end of 7th Street would be removed and the area currently occupied by the tower would be restored to wetland/upland transition and native upland habitats, as described below. Removal of the tower would eliminate a significant perching site for raptors and great blue herons, which have been documented preying on light-footed clapper rail and/or California least tern adults, chicks, and/or eggs.

5. Habitat Restoration
   As described under Alternative B, there are several opportunities for habitat restoration on the approximately 37 acres of disturbed upland habitat located within the Refuge boundary. These same areas would be restored under Alternative C, as illustrated in Figure 3-5, but the habitat proposals for these areas would provide a greater mix of upland and wetland/upland transition habitat than is proposed in Alternative B. The rational for emphasizing these higher elevation habitats in this alternative is to address issues related to sea level rise. Much of the Refuge already supports low elevation salt marsh habitat, with relatively few areas available on the Refuge as high tide refugia for clapper rails and other marsh-dependent avian species. To ensure some areas of upland and upland/wetland transition at the edges of the marsh in the future, not all of the area available for wetland restoration would be used for that purpose under this alternative. The acres of each proposed habitat type per restoration site are provided in Table 3-5.

   The Case Road Pond site and the area to the southeast of 7th Street Pond would be restored to a range of habitats including intertidal mudflat, salt marsh, wetland/upland transitional, and coastal sage scrub. The intertidal habitats (i.e., mudflat, salt marsh) would include meandering shallow subtidal channels with gentle side slopes to provide a diversity of microhabitats. A disturbed strip of land to the west of 7th Street, an area at the southwestern end of the 7th Street Pond, and a portion of the area around the existing drop tower would be restored to wetland/upland transitional habitat. The area located to the east of the drop tower would be restored to salt pan habitat, and as discussed in Alternative B, the inactive monitoring wells in the vicinity of 7th Street and the bunkers to the west of 7th Street Pond would be removed prior to restoration.

   These restoration proposals could be implemented under one project proposal, or the restoration could be phased over a number of years. The extent and timing of when various restoration proposals are implemented would be dependent upon the level of funding that is secured to implement restoration. The overall cost of implementing the restoration proposals would be lower if all of the sites could be restored as part of single project, but this option may not be feasible based on the limited availability of funding sources for restoration.

Table 3-5 Habitat Restoration Proposals for Alternative C		
Area	**Area (acres)**	**Habitat to be Restored**
Northern portion of Case Road Pond site	8	Upland (coastal sage scrub)
iddle portion of Case Road Pond site	4	Wetland/upland transition
Southern portion of Case Road Pond site	10	Intertidal salt marsh and mudflat
Eastern-most island in the Case Road Pond	1	Seabird nesting site
Northern portion of area to southeast of 7th Street Pond	5	Intertidal salt marsh and mudflat
Middle portion of area to southeast of 7th Street Pond	1	Wetland/upland transition
Southern portion of area to southeast of 7th Street Pond, and square area where the drop tower is currently located	3	Upland (coastal sage scrub)
Northern portion of area at southwestern tip of 7th Street Pond	1	Wetland/upland transition
Southern portion of area at southwestern tip of 7th Street Pond	1	Salt pan habitat
Strip of land to the west of 7th Street Pond	3	Combination of wetland/upland transition and upland (coastal sage scrub)

Conventional land excavators, motor graders, and dump trucks would be used to achieve the desired elevations and excess material would be removed to an appropriate offsite location. The restoration proposals in Alternative C include 11 acres of restored coastal sage scrub. Little, if any, earthwork would be required to prepare these areas for restoration. All of the restoration proposals in Alternative B would require some level of earthwork, with the greatest volume of cut occurring in areas proposed for intertidal salt marsh and mudflat habitat. As a result, the amount of grading necessary to implement Alternative C would be considerably less that that required for Alternative B. The specific details regarding volumes of cut and fill and overall site design and grading would be provided during the preparation of preliminary and final restoration plans and construction specifications.

Once grading has been completed and the desired elevations have been achieved, native plants appropriate to the range of elevations present at each site would be installed to supplement natural species recruitment. Areas proposed for wetland/upland transitional and coastal sage scrub would require the greatest density of installed plant material. Wetland/upland transitional habitat and coastal sage scrub habitat would be planted in the fall when temperatures are cooler and the likelihood for precipitation is higher. The native wetland/upland transitional vegetation would consist of species such as alkali heath, estuary seablite, alkali weed, salt grass, sea lavender, and shore grass. The primary components of the coastal sage scrub habitat would include flat-top or California buckwheat, California sagebrush, lemonade berry, coyote brush, coast sunflower, white sage, and coastal goldenbush. Soil amendments and a moisture gel packs would be used as described under Alternative B.

Under this alternative, the non-native vegetation on the four highest mounds of the eastern-most island in Case Road Pond would be removed and the sites topped with

clean sand suitable for nesting by ground nesting seabirds such as Forster's terns (*Sterna forsteri*) and black skimmers (*Rhynchops niger*).

Also, as described under Alternative B, other areas of upland adjacent to pathways, along the edges of existing wetland areas, and beyond the shoulder of existing roadways would be planted with native upland species following invasive plant removal.

6. Integrated Pest Management
   The Integrated Pest Management (IPM) Plan (Appendix C) proposed under Alternative B would also be implemented under Alternative C.

7. Mosquito Management
   Under Alternative C, mosquito management on the Refuge would be implemented through the phased approach summarized in Alternative B and presented in detail in the Mosquito Management Plan presented in Appendix D. The only difference between Alternatives B and C with respect to mosquito management and control is that under Alternative C, the use of the larvicide Natular would not be permitted for use on the Refuge.

Public Use Program

Alternative C proposes to expand the existing visitor services opportunities on the Refuge. The current monthly tours and special tours would continue to be provided in coordination with NWSSB, as would on- and off-Refuge environmental education activities. This alternative also proposes to work with NWSSB to increase public access onto the Refuge for wildlife observation and environmental education purposes. In addition, in partnership with the NWSSB, funding would be sought to design and construct a two-level, 20-foot-high observation tower along the east side of Kitts Highway across from the Refuge Headquarters.
Under this alternative, the Refuge, together with NWSSB, would also increase the promotion of opportunities for environmental education and connecting people with nature on the Refuge by supporting requests for visits to the Refuge by educational institutions, non-governmental organizations, and archaeological/historical societies.

Refuge Operations

In addition to the actions addressed under Alternative B, this alternative proposes to expand on-site Refuge staff, which currently consists of a full-time Refuge Manager and a part-time maintenance worker, to also include a full-time Wildlife Biologist. This proposal is addressed in greater detail in Chapter 6.

Coordination with NWSSB

Coordination with NWSSB would continue as described in Alternative A.

Environmental Contaminants Coordination

Environmental contaminants coordination would continue to be implemented as described in Alternative A.

Cultural Resource Management

Cultural resource management would be implemented as described in Alternative B.

Volunteers and Partners

Support for the Friends of Seal Beach NWR would continue as described in Alternative A and coordination with the Refuge's other partners, including NWSSB, would continue to be an important Refuge strategy.

3.4.4 Alternatives Considered but Eliminated from the Detailed Analysis

The alternatives development process is designed to allow consideration of the widest possible range of issues and potential management approaches. During this process, various objectives and strategies for achieving Refuge goals were considered but not selected for detailed study. Those alternatives that were eliminated from detailed study are presented below.

Expand the Number of California Least Tern Nesting Sites within the Refuge

The potential for providing additional locations on the Refuge to support nesting least terns was given considerable thought by the planning team, and was discussed with other interested parties during our Habitat and Wildlife Management Review. The general consensus was that the existing least tern site on the Refuge has adequate capacity to support additional pairs of terns and there is currently no need for an additional site on the Refuge. Adding another site would require splitting time spent by predator management and monitoring personnel between the existing site and the new site, which could result in reduced protection for nesting birds at both locations. Based on these factors, identifying additional least tern nesting sites on the Refuge was eliminated from detailed study.

Expand the Refuge Boundary to Include the Los Cerritos Wetlands

During the public comment period, the suggestion was made that the Los Cerritos Wetlands, located approximately one mile to the northwest of the Refuge, be incorporated into the boundaries of the Seal Beach NWR. These wetlands are currently overseen by the Los Cerritos Wetlands Authority, a joint powers authority of the City of Long Beach, City of Seal Beach, State Coastal Conservancy, and the Rivers and Mountains Conservancy. The purpose of the Authority is to provide for a comprehensive program of acquisition, protection, conservation, restoration, maintenance and operation and environmental enhancement of the Los Cerritos Wetlands area consistent with the goals of flood protection, habitat protection and restoration, and improved water supply, water quality, groundwater recharge and water conservation. The Authority has the ability to acquire and own real property and to conduct and implement restoration planning.

Including the Los Cerritos Wetlands within the management responsibilities of the Seal Beach NWR was determined to be outside the scope of the purposes for which the Seal Beach NWR was established. Additionally, these wetlands, which are not contiguous with Anaheim Bay, are currently being managed by a Joint Powers Authority (JPA), consisting of local, state, and a nongovernmental agency. This JPA has been established for the specific purpose of overseeing the comprehensive conservation of these wetlands.

Include Oil Island into the Refuge Following Termination of Oil Production Activities

Several proposals were initially considered for the reuse of Oil Island once oil production ceases at this site. However, after further review, the reuse of Oil Island is not currently a viable option based on the operator's current agreement with the Navy. This agreement requires that Oil Island be removed and salt marsh habitat to be restored when oil production ceases at this location. Any proposal to do something other than restore salt marsh habitat at this site would require a full evaluation of alternatives, appropriate NEPA documentation, and potential permits from various state and/or federal agencies.

Improve Public Access onto the Refuge

A number of comments were received during the scoping process related to improving the public's ability to gain access onto the Refuge. Some proposals sought to reduce the restrictions for access onto the Refuge through NWSSB, while others suggested creating a new access point that would allow direct access onto the Refuge from adjacent properties to the southeast. These proposals were considered but eliminated from further analysis because these access proposals would have conflicted with the mission of NWSSB.

3.4.5 Comparison of Alternatives by Issue

Table 3-6 presents an issue-by-issue comparison of the three management alternatives described in this chapter for the Seal Beach NWR.

Table 3-6
Comparison of Alternatives for the Seal Beach NWR CCP

Issue Raised During Scoping	Alternative A (No Action)	Alternative B (Maximize Salt Marsh Restoration, Continue Current Public Uses)	Alternative C – Preferred Alternative (Optimize Upland/Wetland Restoration, Improve Opportunities for Wildlife Observation)
Wildlife and Habitat Management			
Expand nesting habitat for the California least tern on the Refuge	Expansion of least tern nesting habitat is not proposed; refer to Section 3.4.4. Instead, continue to support and maintain the current least tern nesting site on NASA Island	Same as Alternative A	Same as Alternative A
Increase the overall population of light-footed clapper rails on the Refuge	Continue to implement predator management; conduct monitoring; maintain nesting platforms; and occasionally release captive-bred rails into the marsh	Same as Alternative A, as well as protect and study the Refuge's natural rail nesting areas to better understand the conditions and then manage for these conditions elsewhere on the Refuge; work with partners to improve the design of clapper rail nesting platforms, all in an effort to increase fledgling success	Same as Alternative B, as well as study the potential for improving the habitat quality of the Refuge's cordgrass habitat for nesting rails
Reduce the potential for avian predation of least terns and light-footed clapper rails	Continue to implement the predator management actions included in the approved Endangered Species Management and Protection Plan (*USFWS and Navy 1991*)	Same as Alternative A, as well as coordinate with NWSSB to eliminate potential perching sites on power poles and other structures on and around the Refuge	Same as Alternative B, as well as remove the drop tower near the 7th Street Pond that provides perching for raptors and great blue herons
Establish the Federally listed endangered plant, salt marsh bird's-beak, on the Refuge	No plans to establish salt marsh bird's-beak on the Refuge	No plans to establish salt marsh bird's-beak on the Refuge	Identify appropriate locations for establishing salt marsh bird's-beak on the Refuge, sow seeds, and monitor these sites for plant establishment and annually reproduction
Expand the acreage available for seabird nesting on the Refuge	Continue to maintain NASA Island as a California least tern nesting site	Same as Alternative A	Provide 0.6 acre of seabird nesting habitat on the easternmost island in Case Road Pond
Manage appropriate habitats on the Refuge to support tiger beetles	No active management for tiger beetles on the Refuge	Establish baseline data for tiger beetle diversity and abundance on the Refuge	Same as Alternative B, as well as implement, as appropriate, tiger beetle habitat management
Address the effects of climate change/sea level rise on habitat quality	No actions are being implemented to address climate change or sea level rise	Monitor sea level rise, changes in habitat quality and species composition over time; and evaluate potential actions to address these changes	Same as Alternative B
Address issues related to wind/water erosion in restored wetland areas	Continue to maintain existing culverts and areas with existing slope protection	Same as Alternative A, as well as monitor, record, and photo-document ongoing changes and develop methods for reducing erosion as appropriate	Same as Alternative B
Expand the Refuge boundary to include the Los Cerritos Wetlands	Current refuge management does not include the Los Cerritos Wetlands	Expansion of refuge management to include the Los Cerritos Wetlands is not proposed (refer to Section 3.4.4 for additional details)	Same as Alternative B

Table 3-6 (continued) Comparison of Alternatives for the Seal Beach NWR CCP			
Issue Raised During Scoping	**Alternative A (No Action)**	**Alternative B (Maximize Salt Marsh Restoration, Continue Current Public Uses)**	**Alternative C – Preferred Alternative (Optimize Upland/Wetland Restoration, Improve Opportunities for Wildlife Observation)**
Habitat Restoration			
Restore upland habitat to expand the Refuge's native habitat diversity	Continue to control invasive plant species on the upland areas within the Refuge, as well as install native plants following invasive plant control to prevent reinvasion of nonnative species	Same as Alternative A, as well as work with the Navy to expand invasive plant control to include NWSSB lands adjacent to the Refuge; expand invasive species control on the Refuge and plant appropriate upland species to prevent reinvasion of nonnative plants	Same as Alternative B, as well as restore 11 acres of coastal sage scrub habitat on the Refuge, including 8 acres north of Case Road Pond and 3 acres southeast of the 7th Street Pond
Expand wetland habitat on the Refuge	Continue to manage the ±950 acres of coastal wetlands within the Refuge boundary to support fish, birds, and other marine organisms	Restore 22 acres of intertidal habitat (i.e., 12 acres to the north of Case Road Pond, 8 acres to the southeast of 7th Street Pond, 2.4 acres to the southwest of 7th Street Pond) and an additional 15 acres of wetland/upland transition habitat throughout the restoration areas to support coastal dependent species	Restore 14 acres of intertidal habitat (i.e., 10 acres north of Case Road Pond, 5 acres to the southeast of 7th Street Pond) and 10 acres of wetland/upland transition habitat throughout the restoration areas to support coastal dependent species
Public Use			
Provide the public with opportunities to enjoy the resources preserved on the Refuge	Continue to provide monthly public tours of the Refuge, as well as special tours and other special events	Same as Alternative A	Same as Alternative A, as well as work with NWSSB to increase the number of opportunities available annually for wildlife observation and environmental education purposes
Construct new facilities to improve opportunities for wildlife observation	Current opportunities for wildlife observation are provided along the interpretive trail that extends from the Refuge office/visitor contact station to the observation deck on Bolsa Avenue	Same as Alternative A	Same as Alternative A, as well as partner with the NWSSB to construct an elevated observation deck along the east side of Kitts Highway across from the Refuge office/visitor contact station
Support environmental education	Continue to support the Friends in their efforts to implement on- and off-refuge environmental education programs	Same as Alternative A	Same as Alternative A
Improve the public's ability to access the Refuge	Continue to work with the NWSSB to accommodate opportunities for the public to access the Refuge when accompanied by Refuge or NWSSB personnel	Same as Alternative A	Same as Alternative A (refer to Section 3.4.4. for more information)
Refuge Operations			
Provide adequate funding/staffing to achieve Refuge goals	Continue current staff levels and provide support and encouragement for the Refuge's Friends Group	Same as Alternative A	Expand on-site Refuge staff by adding a full time Wildlife Biologist
Research			
Encourage research that will benefit Refuge resources and future Refuge management	Continue to support research on the Refuge that benefits Refuge management while taking into consideration potential endangered species impacts and Navy access restrictions	Identify needed areas for research and possible associated studies that benefit Refuge management and resources and are consistent with Refuge purposes and the mission of the NWRS	Same as Alternative B

4 Refuge Resources

This chapter presents relevant information regarding the affected environment in and around the Seal Beach NWR. Additional details regarding some aspects of the effected environment are presented in two additional documents: 1) draft Integrated Natural Resources Management Plan for Naval Weapons Station Seal Beach (*U.S. Navy 2011*); and 2) The Natural Resources of Anaheim Bay (*CDFG and USFWS 1976*). Relevant information from these two documents is summarized in this chapter and the documents themselves are incorporated herein by reference.

4.1 Environmental Setting

4.1.1 Location and Property Description

Seal Beach NWR, which encompasses approximately 965 acres, is located in the northwest corner of Orange County between the City of Seal Beach to the northwest and the City of Huntington Beach to the southeast (Figure 4-1). The Refuge is buffered from the surrounding urban development on the north, east, and west by NWSSB, while the boating and residential development associated with Sunset Harbour Marina and the community of Huntington Harbour border the Refuge to the south.

The coastal wetlands of Anaheim Bay, consisting of tidal channels, tidal flats, and salt marsh habitat, occupy the majority of the Refuge (748 acres). Another 116 acres (often referred to as the Anaheim Bay Wetlands Restoration Project) support restored wetlands constructed by the Port of Long Beach in 1990. This restoration project was implemented to mitigate the loss of fish habitat associated with the expansion of Pier J in San Pedro Bay. Restoration involved the creation of four tidal basins: Forrestal Pond, Case Road Pond, 7th Street Pond, and Perimeter Pond (refer to Figure 4-1), as well as the construction of feeder channels, dikes, and culverts needed to facilitate tidal flow in and out of the basins. Forrestal and Perimeter Ponds provide subtidal habitat to support marine fish, while Case Road and 7th Street Ponds were constructed to provide a mix of channels and islands to support both fish and bird habitat (*Moffatt & Nichol Engineers 1987*).

The remaining acreage includes: NASA Island, a three-acre least tern nesting site; Hog Island, supporting upland habitat; muted salt marsh habitat in the Bolsa Cell, located north of Bolsa Avenue; disturbed upland to the north of the Case Road Pond and to the south and west of the 7th Street Pond; and some 40 acres of developed land consisting of roads, railroad tracks, and miscellaneous structures (refer to Figure 4-1). The Refuge office and a native plant garden are located on approximately four acres at the southwest corner of Kitts Highway and Bolsa Avenue, outside of the Refuge boundary.

4.1.2 Flyway Setting

Situated along the Pacific Flyway, the Seal Beach NWR is an important stopover and wintering location within the Flyway for thousands of shorebirds and waterfowl migrating between wintering and breeding grounds. The Refuge provides foraging and resting habitat for migrating shorebirds in the fall and spring and important wintering habitat for waterfowl. Spring migration occurs from February through May for species moving north, while fall migration begins in late summer for bird heading south. Peak bird abundance typically occurs from November through February (*U.S. Navy 2011*).

Figure 4-1. Seal Beach NWR – Site Plan

4.1.3 Historic Setting

In the 1890s, the 55-mile-long coastline along the western boundary of Los Angeles and Orange counties included seven major coastal wetlands collectively supporting over 17,300 acres of salt marsh, tidal channel, mudflat, and salt pan habitat (Figure 4-2 and Table 4-1). One of these wetlands was Anaheim Bay. Anaheim Bay and its associated salt marsh complex occupied an area of approximately 2,300 acres in 1875 (Figure 4-3). Several creeks, including Anaheim Creek, emptied into the bay from the north providing important seasonal freshwater flows.

Table 4-1
Historical Acreages of Coastal Los Angeles and Orange County Wetlands*

Wetland	Area (acres)
Newport Bay	2,350
Santa Ana River Marsh	2,950
Bolsa Bay	2,300
Anaheim Bay	2,300
New River Slough (Alamitos Bay)	2,400
San Pedro Bay	3,450
Ballona Bay	1,550
Total	**17,300**

*Acreages obtained from a series of topographic sheets covering areas surveyed in 1894. Source: (*CDFG and USFWS 1976*)

The first major change to Anaheim Bay occurred in the 1860's when a small boat port was created at the entrance to the bay. This area was known as Anaheim Landing. In 1904, the Pacific Electric Railway constructed a rail line along what is now the alignment of Pacific Coast Highway, just to the south of the Refuge (*CDFG and FWS 1976*). Between the 1870's and the 1940's Anaheim Bay was used primarily for hunting and fishing (*U.S. Navy 2011*). Photographs taken in the 1920s of the area now occupied by the Refuge and Naval Weapons Station indicate that some portions of Anaheim Bay were likely filled to support agricultural uses prior to the Navy's acquisition of the land (Figure 4-4).

Major changes to the bay occurred following the Navy's acquisition of the property in 1944 when the harbor and wharves were constructed at the entrance to the bay. Other portions of the wetlands were altered to construct roads, dikes, islands, magazines, and other fills needed to support the general activities of an ammunition depot (*U.S. Navy 1988*). In 1954, a private company that held the mineral rights for the area below Anaheim Bay filled approximately 6.5 acres of wetland near the center of Anaheim Bay to create a base from which oil and natural gas could be extracted. The most significant changes to Anaheim Bay began in the 1960s, when more than 850 acres of salt marsh habitat located adjacent to present day NWSSB were acquired by the Huntington Harbour Corporation to build a marine-oriented residential development. The dredging and filling that began in 1961 and lasted for 14 years developed all of the wetlands that historically occurred to the east of Sunset Beach (*CDFG and FWS 1976*). Another 63 acres of marshland, property declared surplus land by the Navy, was sold to Orange County in 1962. Much of this land was subsequently developed into a marina, resulting in the further reduction of the historic Anaheim Bay wetlands. Figure 4-5 illustrates the changes that have occurred in Anaheim Bay between 1873 and 1976.

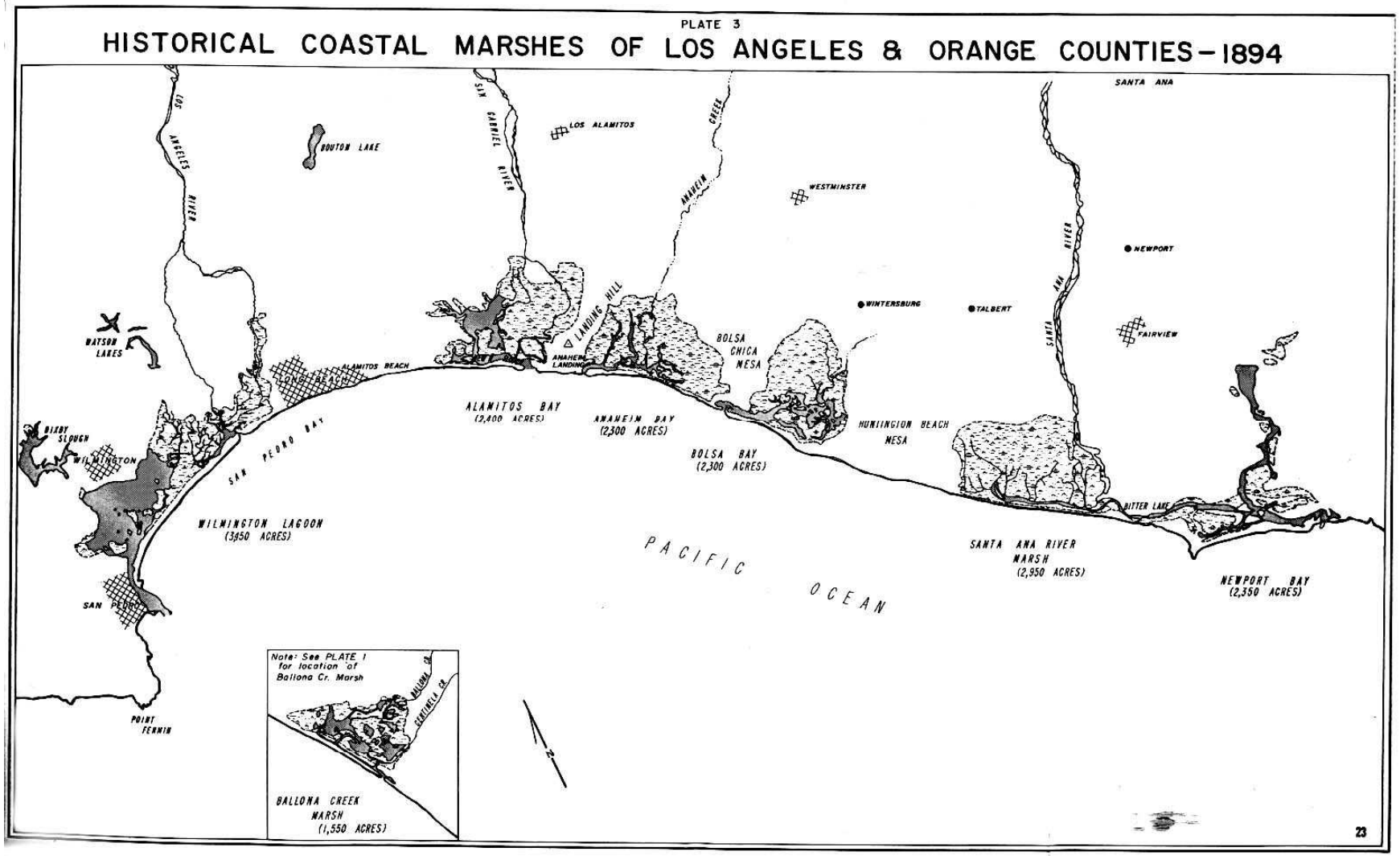

Figure 4-2. Historical (1894) Coastal Wetlands of Los Angeles and Orange Counties

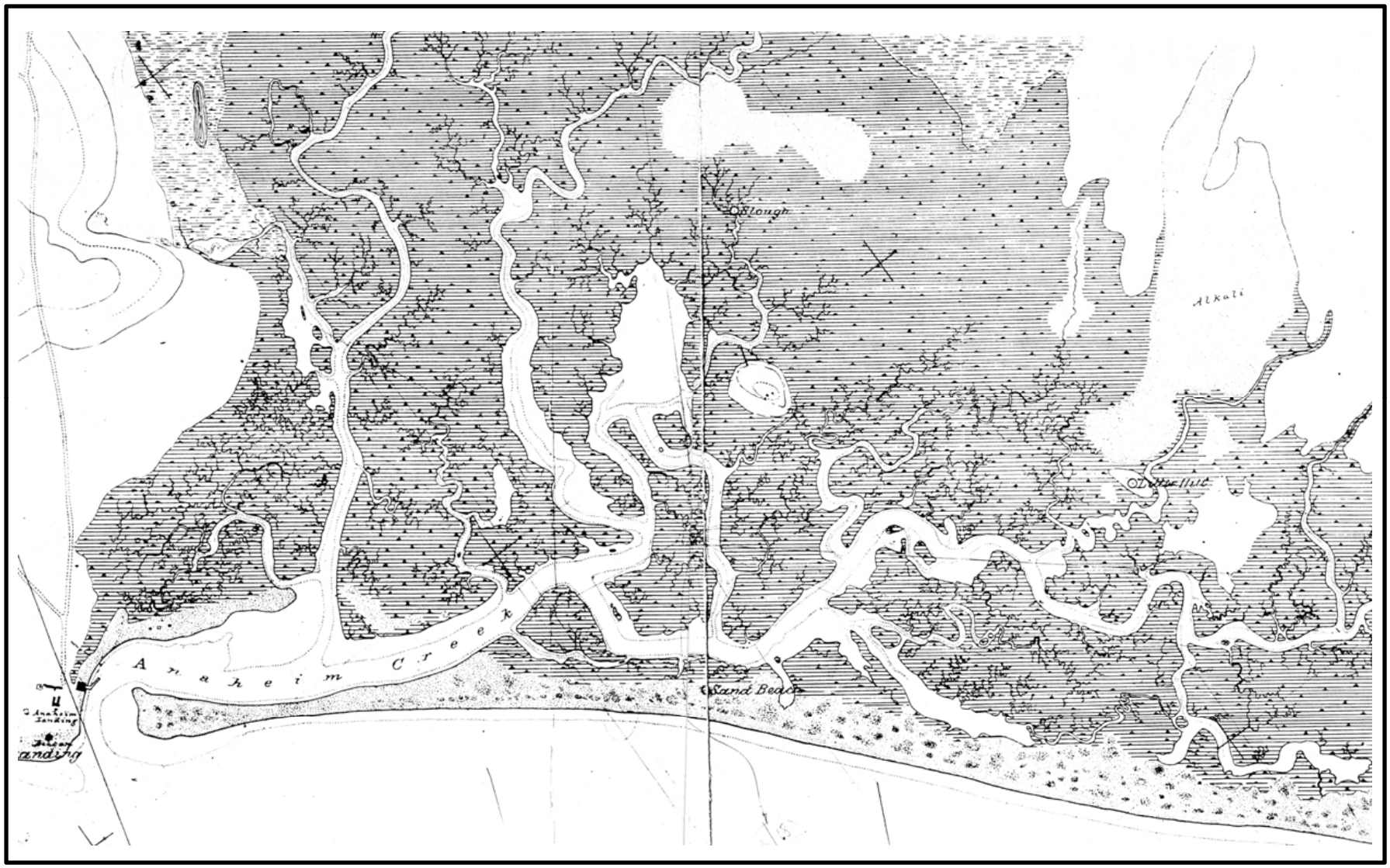

Figure 4-3. Historical (1875) Wetlands of Anaheim Bay

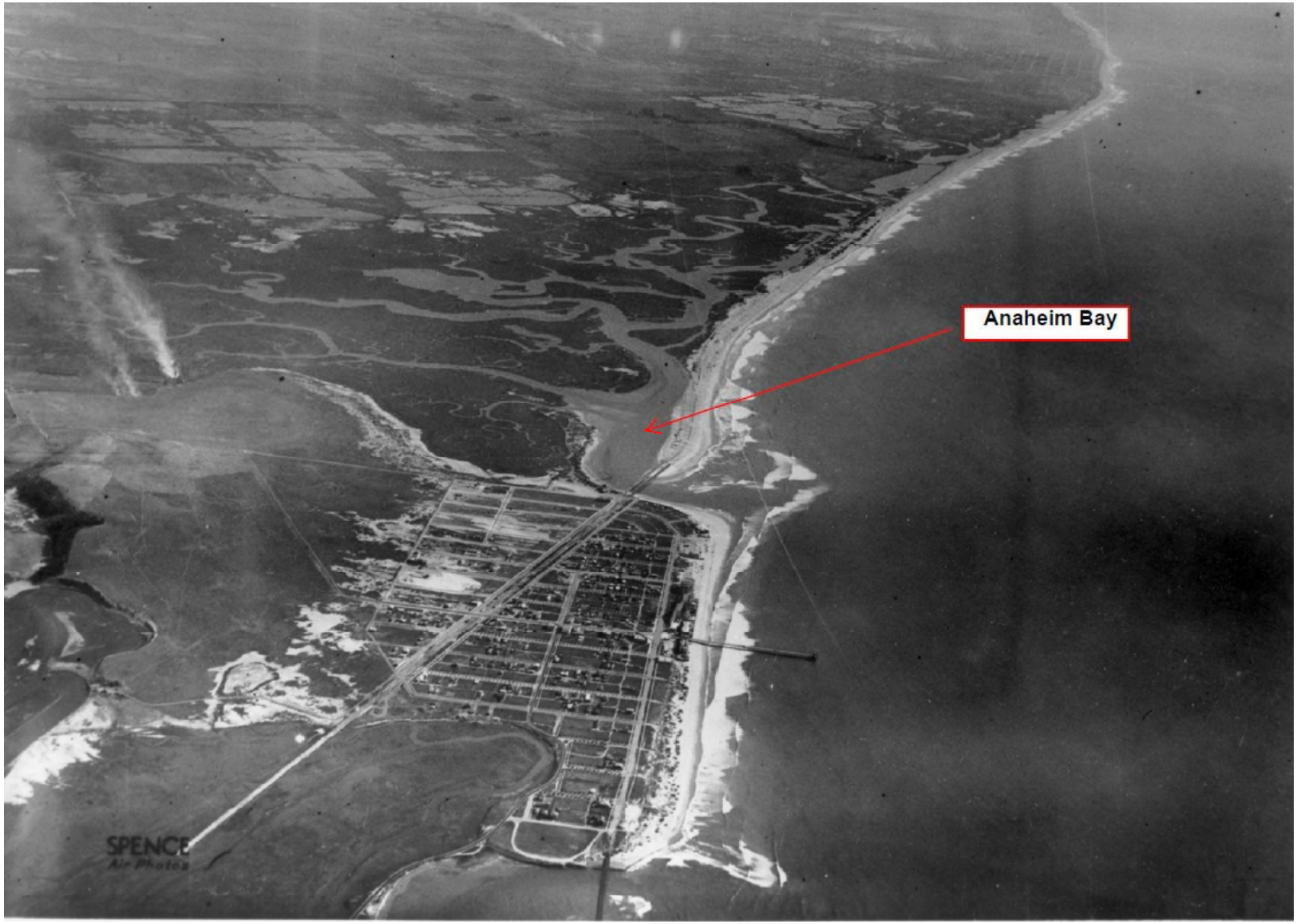

Figure 4-4. Aerial View of Anaheim Bay and the Salt Marsh Complex in 1922

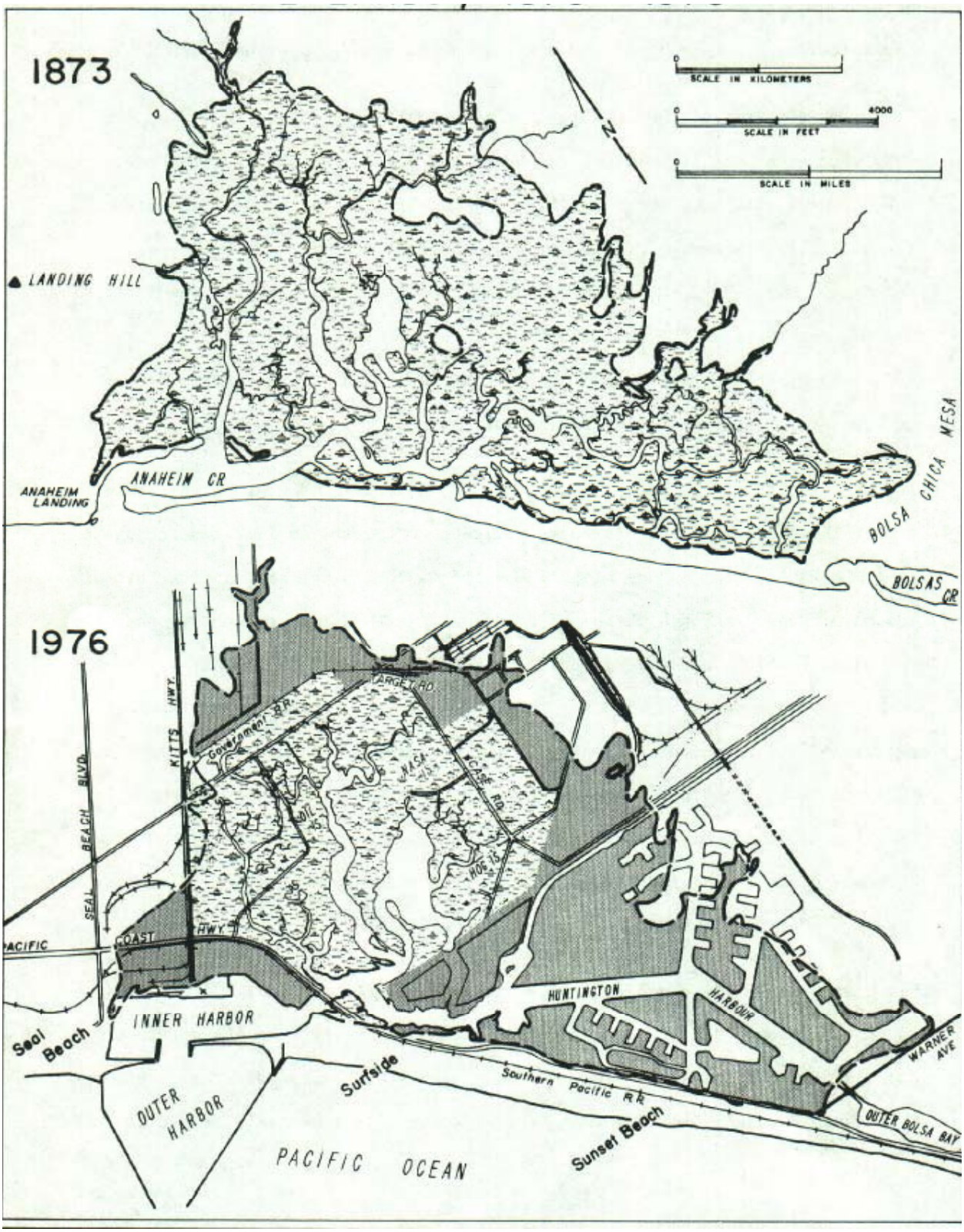

Figure 4-5. Comparison of Anaheim Bay in 1873 and 1976

With the exception of the area restored by the Port of Long Beach in 1990, the configuration of the marsh plain and associated tidal channels protected within the Refuge boundary remains much the same as it was in the 1800s (refer to Figure 4-5). Although wider in some places and more constricted in others, the tidal creeks remain in essentially the same locations, as does the extensive marsh plain. Habitat quality has however been compromised to some degree by a reduction in the marsh's tidal prism following the completion of Huntington Harbour, as well as by the significant reduction in seasonal freshwater flows that once flowed into the marsh. The volume of freshwater entering the marsh was significantly reduced following the flood of 1862, which changed the course of the Santa Ana River, diverting the floodway well to the south of Anaheim Bay. As a result of this and other major flood events, the watershed upstream of Anaheim Bay continued to be altered through the construction of flood control channels, including the construction of the Bolsa Chica and East Garden Grove-Wintersburg flood control channels. These channels divert essentially all of the freshwater flow from the streams and creeks upstream of Anaheim Bay. Instead of following through the marsh, these flows follow a man-made channel around the eastern edge of NWSSB and empty directly into the western end of Anaheim Bay (Figure 4-6). Despite the changes that have occurred in Anaheim Bay over the past 100 years, 748 acres of the marsh remain essentially intact and represent some of the best quality coastal wetland habitat remaining in southern California. This is due in large part to regular, unobstructed tidal influence that supports a diversity of plants, fish, birds, and other coastal dependent organisms.

4.2 Physical Environment

Elements of the physical environment include topography, visual quality, geology/soils, agricultural resources, mineral resources, paleontology, hydrology/water quality, climate/climate change/sea level rise, air quality, greenhouse gas emissions, contaminants, and noise.

The Quaternary alluvium floodplains that dominant the area included within the Seal Beach NWR were formed during recent times, therefore the potential for the presence of paleontological resources beneath the surface is very low, particularly in the upper levels of the formation. Fossils have however been found at greater depths in nearby areas underlain by the same geological formations. Because of the low potential for paleontological resources and the limited potential for significant ground disturbing activity on the Refuge, no effects to paleontological resources are anticipated; therefore, this topic is not addressed any further in the EA. Similarly, the Seal Beach NWR is not located in proximity to any sensitive noise receptors (e.g., housing, hospitals, libraries), therefore, there is no potential for adverse noise impacts to such uses as a result of activitities occurring on the Refuge. No further discussion related to noise is therefore required.

4.2.1 Topography/Visual Quality

The elevations within the 965-acre Refuge range from -2.0 feet below mean sea level (MSL) to just over 9.0 feet above MSL. The majority of the Refuge, approximately 793 acres, supports tidal channels, associated mud flats, and extensive areas of salt marsh (Figure 4-7). The areas restored as part of the Port of Long Beach mitigation project include 116 acres divided among four tidal basins and several feeder channels that facilitate tidal exchange within the basins. Forrestal and Perimeter ponds support open water habitat, while Case Road Pond and 7th Street Pond support a combination of open water, salt marsh, and periodically exposed mudflats. The Case Road and 7th Street Ponds also include constructed islands that support a range of intertidal habitats. These islands average about 1.7 feet above MSL. The easternmost island in the Case Road Pond includes several mounds that achieve an elevation of approximately four feet above MSL.

Figure 4-6. Oblique Aerial View of the Seal Beach NWR, Anaheim Bay, Northern Orange County and Distant Santa Ana Mountains

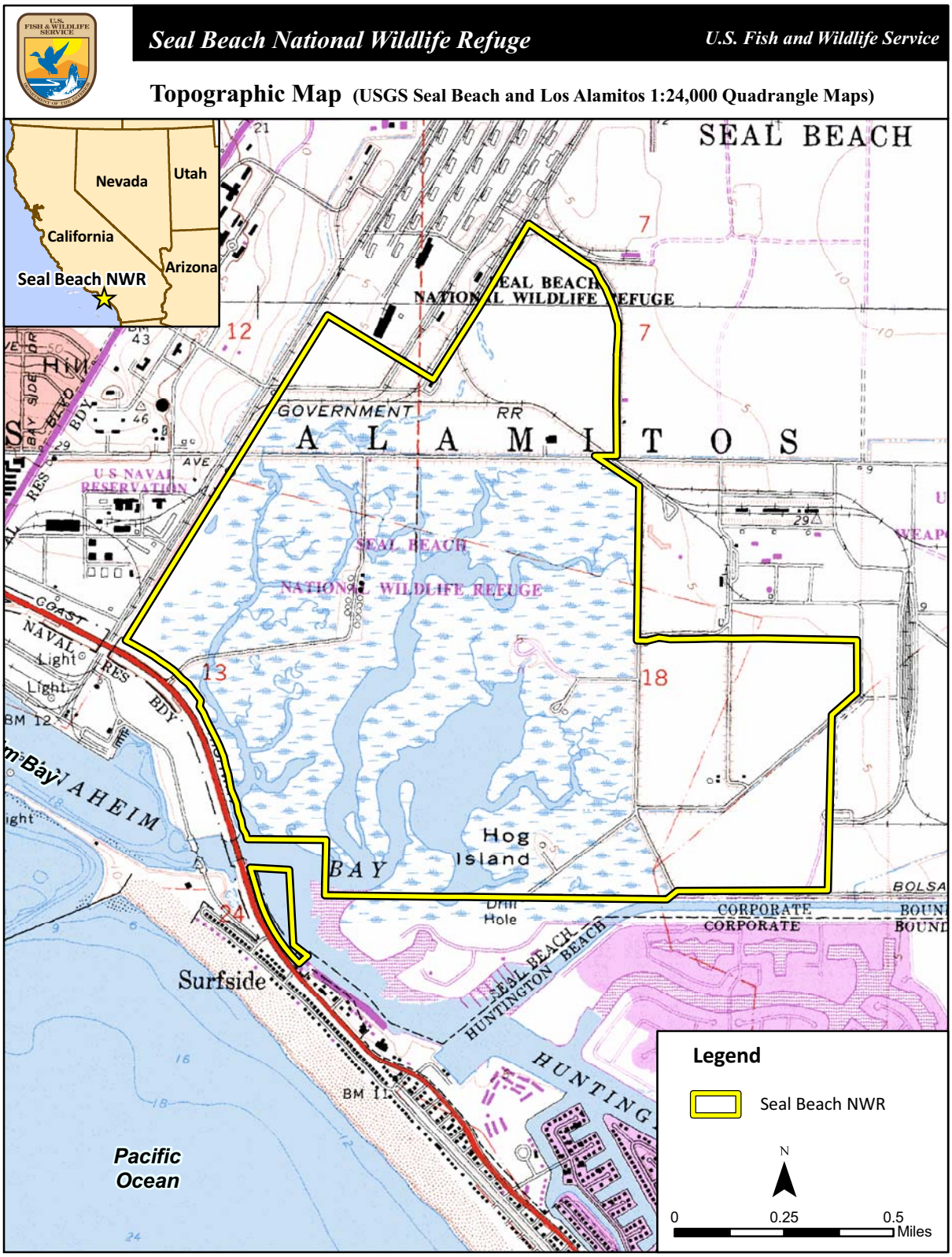

Figure 4-7. USGS Topographic Map for the Seal Beach National Wildlife Refuge

Overall, the Refuge is relatively flat with little visible topographic relief. The highest areas on the Refuge landscape are those furthest inland near the northern boundary, where unaltered natural elevations rise to about 5.0 above MSL. The area north of Case Road Pond ranges from about 3.5 to 5.3 feet above MSL and the area to the southeast of the 7th Street Pond ranges from 3.8 to 4.8 feet above MSL. The site of the existing drop tower appears to have been filled in the past and is currently situated at about 7.5 feet above MSL. Forrestal Avenue ranges from 9.1 to 8.9 feet above MSL, while Bolsa Avenue where it crosses the Refuge ranges from 5.9 feet above MSL to a low of 4.3 feet above MSL.

Within the marsh plain, the highest sites, including NASA Island and Oil Island, have been artificially filled to achieve an elevation range above the highest high tides, approximately 10 to 15 feet above MSL. Other portions of the site filled to accommodate roads, dikes, levees, and rail lines, range from 8 to 15 feet above MSL. Hog Island, the only natural upland area within the marsh, is situated approximately 10 feet above MSL.

The steepest topography on the Refuge consists of the banks alongside roads, dikes, and levees that slope, sometimes steeply over very short distances, into the tidal marsh (Figure 4-8). These banks are subject to erosion and slumping (*Everest 2007*). The most significant visual asset of the Refuge, viewed both from on the Refuge itself, as well as from nearby areas on NWSSB and along Pacific Coast Highway and Seal Beach Boulevard, is the undeveloped marsh plain where green and brown marsh vegetation and open water are the dominant elements. While occurring on a small scale, these visual qualities, although compromised somewhat by the visual prominence of nearby artificial structures such as roads, transmission lines, and large buildings, are still valuable to surrounding communities, commuters, and visitors. Vertical elements consisting of large eucalyptus trees and buildings demarcate the perimeter of the Refuge.

Figure 4-8. Steep, Scoured Bank at NE Corner of Kitts-Bolsa Cell

4.2.2 Geology and Soils

The Refuge is underlain by a Pleistocene syncline depression that has been partially filled by alluvial deposits from a combination of historic river flows and tidal origins (*Lane and Woods 1975*). All of the area is part of the historic floodplain for the ancestral, freely migrating Santa Ana, San Gabriel, and Los Angeles Rivers. As a result of a series of floods that occurred in the 1860s, the courses of these rivers shifted to the north and south, and subsequent development and channelization of the rivers ended their ability to freely change course which could have led to a reconnection with Anaheim Bay during a later flood event.

The soils on the Refuge, as described in the Soil Survey for Orange County and parts of Riverside County (*USDA 1978*), are predominately tidal flats that contain stratified clay and sand deposits (Figure 4-9). These soils are poorly drained and have high salt content. The areas to the north of

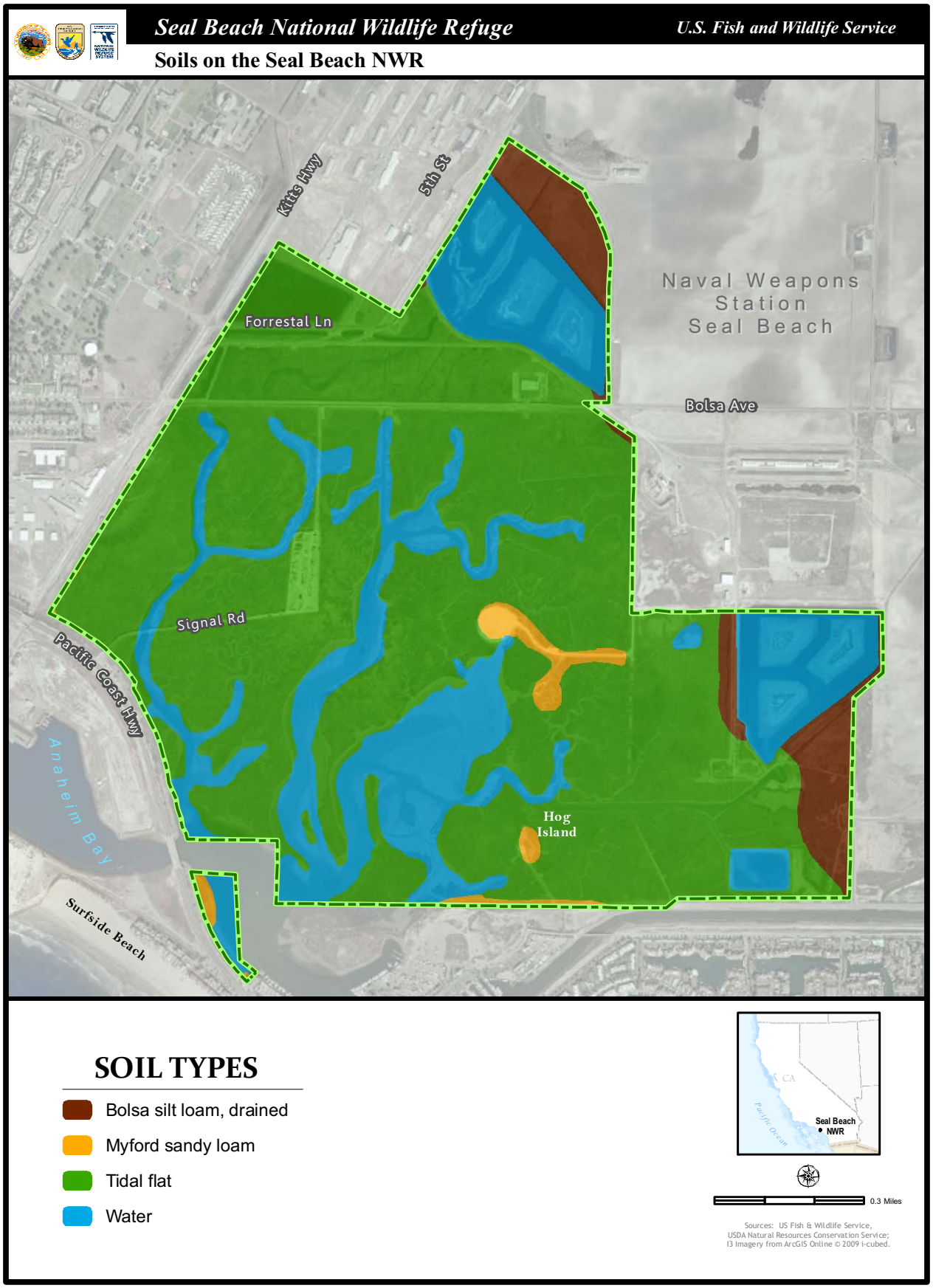

Figure 4-9. Soils Map

Case Road Pond and along the western edge of and to the southeast of the 7th Street Pond appear to be overlain with Bolsa silt loam, drained. This soil type generally occurs on large alluvial fans. A geotechnical investigation conducted in association with the Port of Long Beach restoration project for the Forrestal, Case Road, and 7th Street Pond restoration sites found that there was considerable variation in soil conditions within and between each of the three sites. Generally, subsurface conditions consisted of clean fine to coarse sand to clayey silts and silty clays (*Moffatt & Nichol, Engineers 1987*). The Refuge office and native plant garden are located primarily on Myford sandy loam, which is formed from sandy sediments and generally occurs on broad terraces (*USDA 1978)*.

Anaheim Bay is part of a physiographic region known as Sunset Gap, which is mostly flat and typical of southern California's coastal floodplains. However, within this flat coastal plain is Hog Island, a natural upland area that is part of a dissected scarp of the Newport-Inglewood Fault (*Lane and Woods 1975*). This fault runs parallel to the coast and acts as a hydraulic barrier to lateral ground water movement.

The active Newport-Inglewood Fault Rupture Hazard Zone is a system of right-lateral strike-slip faults that runs northwest through the Refuge (refer to Figure 4-9). This fault zone is associated with the San Andreas system. The estimated potential size of an earthquake along the Newport-Inglewood fault zone ranges from magnitude 6.0 to 7.4. The last major earthquake on this fault, the Long Beach earthquake, was a magnitude 6.3 quake that occurred in March 1933. Another fault zone in the vicinity of the Refuge is the Palos Verdes Fault Zone, which lies 8.5 miles offshore to the southwest.

A serious earthquake hazard exists from the proximity of these fault lines to the Refuge. The resulting damage could be exacerbated by potential liquefaction near the coast. Liquefaction occurs when saturated soils develop a fluid consistency. Liquefied sediment loses strength and may fail, potentially causing damage to buildings, bridges, walls, and other structures. Historically, liquefaction-induced ground failure has been a major cause of earthquake damage in southern California (*DMG 1998*). During the 1971 San Fernando and 1994 Northridge earthquakes, significant damage to roads, utility pipelines, buildings, and other structures was caused by liquefaction-induced ground displacement.

The Seismic Hazards Mapping Act of 1990 directs the California Department of Conservation (DOC), Division of Mines and Geology (DMG) to delineate Seismic Hazard Zones (*DMG 1998*). The map produced by DMG for the Seal Beach quadrangle shows that the entire Refuge is within a liquefaction zone, that is, an area "where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation...would be required" (*DMG 1998*).

Another factor affecting the Refuge is subsidence. Subsidence of shallow marine sediments can occur as a result of groundwater extraction, oil extraction, or tectonic activity. Monitoring studies conducted between 1968 and 1994 have documented both subsidence and rebound in the vicinity of the Refuge (*U.S. Navy 2011*). These studies were conducted due to concerns over possible impacts to habitat quality on the Refuge as a result of subsidence. Subsidence alters the natural elevations within the marsh plain which can have significant adverse effects on the vegetative communities within the marsh, particularly cordgrass-dominated salt marsh habitat (*USFWS 1987*). As the natural elevations are lowered, the depth of the tides relative to the height of the cordgrass increases. This situation can adversely affect the health of the vegetation and the recovery of the light-footed clapper rail, which relies on this vegetation for cover and nesting.

The results of studies conducted between 1968 and 1985 indicated a dramatic change in elevation with subsidence in the range of 0.2 to 0.5 feet occurring within the marsh. Additional studies conducted between 1985 and 1994 indicated that changes in elevation within the marsh had stabilized, with fluctuations of less than 0.1 foot recorded. The later study also showed a slight rebound in elevation with increases of approximately 0.02 to 0.08 feet indicated in all areas (*U.S. Navy 2011*).

4.2.3 Mineral Resources

Oil was first discovered in the Seal Beach area in 1926. The oil field situated under NWSSB, which is located about one-half mile inland of the Pacific Ocean, was originally discovered in 1927. Additional exploration in 1979 led to the discovery of another, yet untapped, portion of this field (*U.S. Navy 2011*). When the Navy acquired the land for NWSSB, the mineral rights were not included as part of the purchase. As a result, today the mineral rights are under private ownership. In 1954, a 6.5-acre island, referred to as Oil Island (refer to Figure 4-1), was created in Anaheim Bay to serve as a base from which oil and natural gas could be extracted. Between 1954 and 1958, 27 wells were drilled to depths ranging from 6,000 to 8,000 feet (*Naval Energy and Environmental Support Activity 1985*). All of the wells are located on the island (*USFWS 1987*). The oil wells on Oil Island continue to operate and have far exceeded their original life expectancy of 15 years.

4.2.4 Agricultural Resources

Approximately 20 acres of upland located to the north of Case Road Pond and another 30 acres of upland located to the south of 7th Street Pond are identified on the Orange County and Western Part of Riverside County Soil Survey map (*USDA 1978*) as being overlain with the soil type Bolsa silt loam, drained. According to the USDA's Land Inventory and Monitoring Project for the Orange County and Western Part of Riverside County Soil Survey (*California Department of Conservation 2009*), this soil type meets the criteria for Prime Farmland. However to be shown on the Farmland Mapping and Monitoring Program's Important Farmland Maps as Prime Farmland, the land must meet both the following criteria:

1. The land has been used for irrigated agricultural production at some time during the four years prior to the Important Farmland Map date, and

2. The soil must meet the physical and chemical criteria for Prime Farmland as determined by the USDA Natural Resources Conservation Service.

The lands on the Refuge that are overlain with Bolsa silt loam have not been in irrigated agricultural production during the past four years. In fact, these lands have not been farmed at any time since the Refuge was established in 1974. As a result, these areas are not identified as Prime Farmland or Farmland of Statewide Importance on the Orange County Important Farmland Map (*California Department of Conservation 2007*). This map does however identify the lands to the east of the Refuge, those lands currently under cultivation on NWSSB, as Prime Farmland.

Another designation considered by the California Department of Conservation is Farmland of Local Importance. These lands represent farmlands that are important to the local economy, as defined by each county's local advisory committee and adopted by its Board of Supervisors. In the case of Orange County, the Board of Supervisors has determined that there is no Farmland of Local Importance within the county.

4.2.5 Hydrology/Water Quality

4.2.5.1 Hydrology

Historically, the Los Angeles Basin was a large, relatively flat area bordered by the San Gabriel Mountains, the San Bernardino Mountains, and Santa Ana Mountains that served as the floodplain through which the Los Angeles, San Gabriel, and Santa Ana Rivers flowed. Prior to channelization, the courses of these rivers were subject to significant changes as a result of major flood events (*USFWS and U.S. Navy, 1990*). Several such events were recorded in the 1800s. The Los Angeles River changed course in 1825 when flood waters redirected river flows from Ballona to San Pedro Bay. In 1862, flood waters caused a reconfiguration of the Santa Ana River course that captured much of the freshwater flows that previously had drained into Anaheim Bay. The San Gabriel River, which prior to 1867 was merely a tributary of the Los Angeles River, shifted its course during heavy floods in the winter of 1867 to create its own course to the ocean through Alamitos Bay (*Lane and Woods 1975, Brennan 2007*). In 1884, another massive flood event resulted in the temporary merging of the Los Angeles, San Gabriel, and Santa Ana Rivers. All of these rivers are now controlled through detention dams and concrete-lined channels.

The construction of flood control structures along the Santa Ana River eliminated floodplain that led to the loss of hundreds of acres of riparian and marsh habitat. Dams, grade control structures, and extensive armoring of the river channel and associated flood control channels now prevent seasonal flooding within downstream marshes, including the salt marsh habitat within the Refuge, and redirect freshwater flows and sediment away from the remaining marsh habitat.

Today, Anaheim Bay is part of the Westminster Watershed, which covers 74.1 square miles in the northwestern corner of Orange County (Figure 4-10). There are three major tributaries, or flood control channels, that drain this watershed, including two, the Bolsa Chica and East Garden Grove-Wintersburg flood control channels that flow into Anaheim Bay. The third, Los Alamitos flood control channel, drains into the San Gabriel River. The Bolsa Chica flood control channel empties into lower Huntington Harbour within the Anaheim Bay-Huntington Harbour complex and the East Garden Grove-Wintersburg channel drains through Outer Bolsa Bay into Huntington Harbour. The latter two channels and their tributaries convey runoff from approximately 90 square miles of watershed, draining much of the northern portion of Orange County, including the highly urbanized cities of Anaheim, Stanton, Cypress, Orange, Santa Ana, Garden Grove, Westminster, Fountain Valley, Los Alamitos, Seal Beach, and Huntington Beach (*California Water Boards 2007*). These channels, which function primarily as flood control channels, direct storm flows and urban runoff around the marshlands in Anaheim Bay rather than draining through them. Nevertheless, the quality of the water carried through these channels does influence water quality within the Refuge, particularly when storm water from the Bolsa Chica channel is pushed into the marsh by the incoming tides.

Approximately 48,000 and 50,000 acres of primarily developed land drain into the Anaheim Bay/Huntington Harbor Complex via the Bolsa Chica and East Garden Grove-Wintersburg flood control channel. The Bolsa Chica channel, which conveys runoff from a large portion of the Bay's watershed, empties into Anaheim Bay between the Sunset Harbour Marina and Huntington Harbour. The channel was designed to carry seasonal storm runoff, which generally amounts to less than 100 acre-feet per month on average; however, the channel also serves as a conduit for urban runoff which tends to flow at low levels throughout the year. Occasionally, severe storms can overwhelm these channels. Upstream of Anaheim Bay, the Bolsa Chica channel overtopped in 1995 when rainfall depths exceeded 100-year and 200-year return frequencies. However,

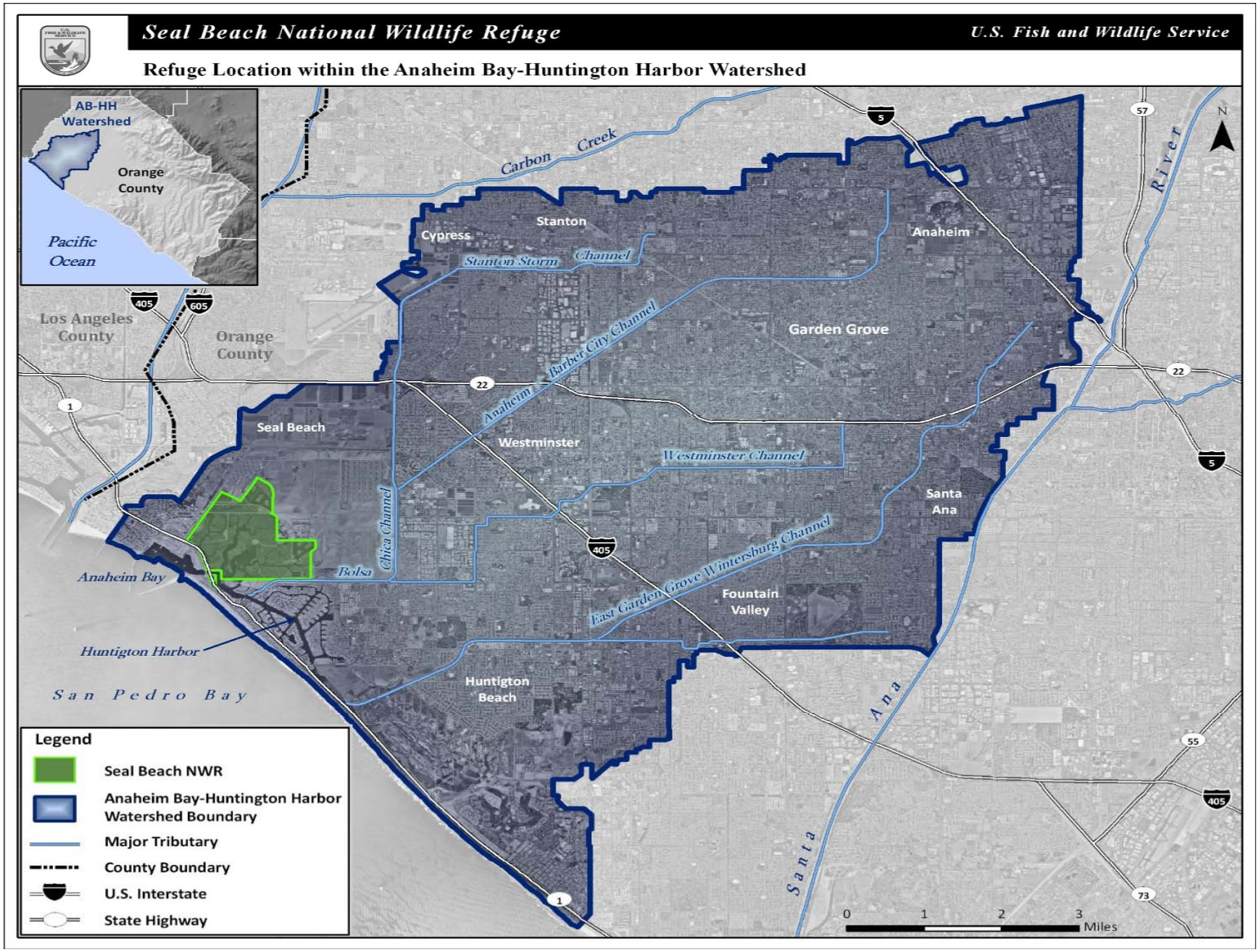

Figure 4-10. Anaheim Bay-Huntington Harbour Watershed

downstream of Interstate 405, in the vicinity of the Refuge, the channel appears to provide adequate flood protection (*U.S. Army Corps of Engineers 2001*).

Today, seasonal freshwater flows into the Refuge are of low volume and intermittent in nature, and are dependent on rainfall and excess landscape irrigation runoff. Some natural rainfall enters the marsh as a result of sheet flow from adjacent upland areas that drain into the marsh during larger rainfall events, while the majority of the freshwater flows enter the Refuge via two small swales. The larger of the two swales parallels Kitts Highway, emptying into the Refuge through a culvert at the northeast corner of Kitts Highway and Bolsa Avenue. The second swale carries runoff from the agricultural areas to the north, draining into the Refuge at the north end of the Case Road Pond (Figure 4-11).

Tidal waters enter and exit the Refuge's wetland areas through a channel that extends under the Pacific Coast Highway bridge and connects the outer harbor of Anaheim Bay with Huntington Harbour and the intertidal wetlands of upper Anaheim Bay. On an incoming tide, ocean water flows through this channel and up the three major tidal channels that extend into the Refuge (refer to Figure 4-1). Generally, two high and two low tides, which range from +7.2 and -1.7 feet mean lower low water, occur each day. On some high tides, the marsh is almost completely submerged with only the highest patches of cordgrass exposed. When the tide is extremely low, extensive mudflats with only a small trickle of water in the upper arms of the tidal slough are visible. The volume of water in the main channel is reduced by 40-50 percent during low tides.

The portion of the Refuge located to the south of Bolsa Avenue and west of 7th Street generally experiences unobstructed regular tidal inundation, however, there are some areas of historic marshland that have been cut off from regular tidal inundation by the construction of roads or other facilities. These areas are generally located at the southeast corner of the Refuge, as well as on Navy lands to the east of the Refuge. One of the first projects implemented on the Refuge to restore tidal flow into a portion of the marsh that was cut off by road construction occurred in 1977 in an area to the east of Case Road and the west of 7th Street. A screw-type tide gate and a headwall were installed in Case Road to improve tidal flow to about 35 acres of degraded salt marsh habitat. Tidal flows were allowed to flow into the area in the winter, but were closed in the summer to reduce the potential for mosquito breeding. Between 1981 and 1982, restoration of the wetland habitat behind Case Road was expanded. Old fills and dikes were removed to fully restore tidal flows and improve habitat diversity and productivity to approximately 100 acres of non-tidal pickleweed flats, salt flats, and weed-dominated uplands.

The area to the north of Bolsa Avenue, as well as the restored ponds on the site (i.e., Forrestal Pond, Case Road Pond, 7th Street Pond, and Perimeter Ponds), which are dependent on constructed channels and culverts to convey tidal flows, are significantly muted compared to a full ocean tide range. The majority of the culverts and constructed channels on the Refuge were installed as part of the mitigation project implemented on the Refuge by the Port of Long Beach.

The Port of Long Beach mitigation project, which restored 116 acres of wetland habitat on the Refuge, was designed to maximize subtidal habitat, such that at least 50 percent of the acreage would be subtidal with an elevation of -4.8 feet mean sea level (MSL) or lower, not more than 35 percent of the acreage would form slopes between -4.8 feet and -0.3 feet MSL (low intertidal), and not more than 15 percent of the acreage would occur above -0.3 feet MSL (high intertidal) (*MEC 1995*). However, at the end of the five-year monitoring program, it was determined that although the project met the intent of the mitigation design, it did not meet the elevation goals. Specifically, 41.5 percent of the total acreage was at or below -4.8 feet MSL, 37.2 percent was between -4.8 and -0.3 feet MSL, and 21.3 percent was above -0.3 feet MSL (*MEC 1995*).

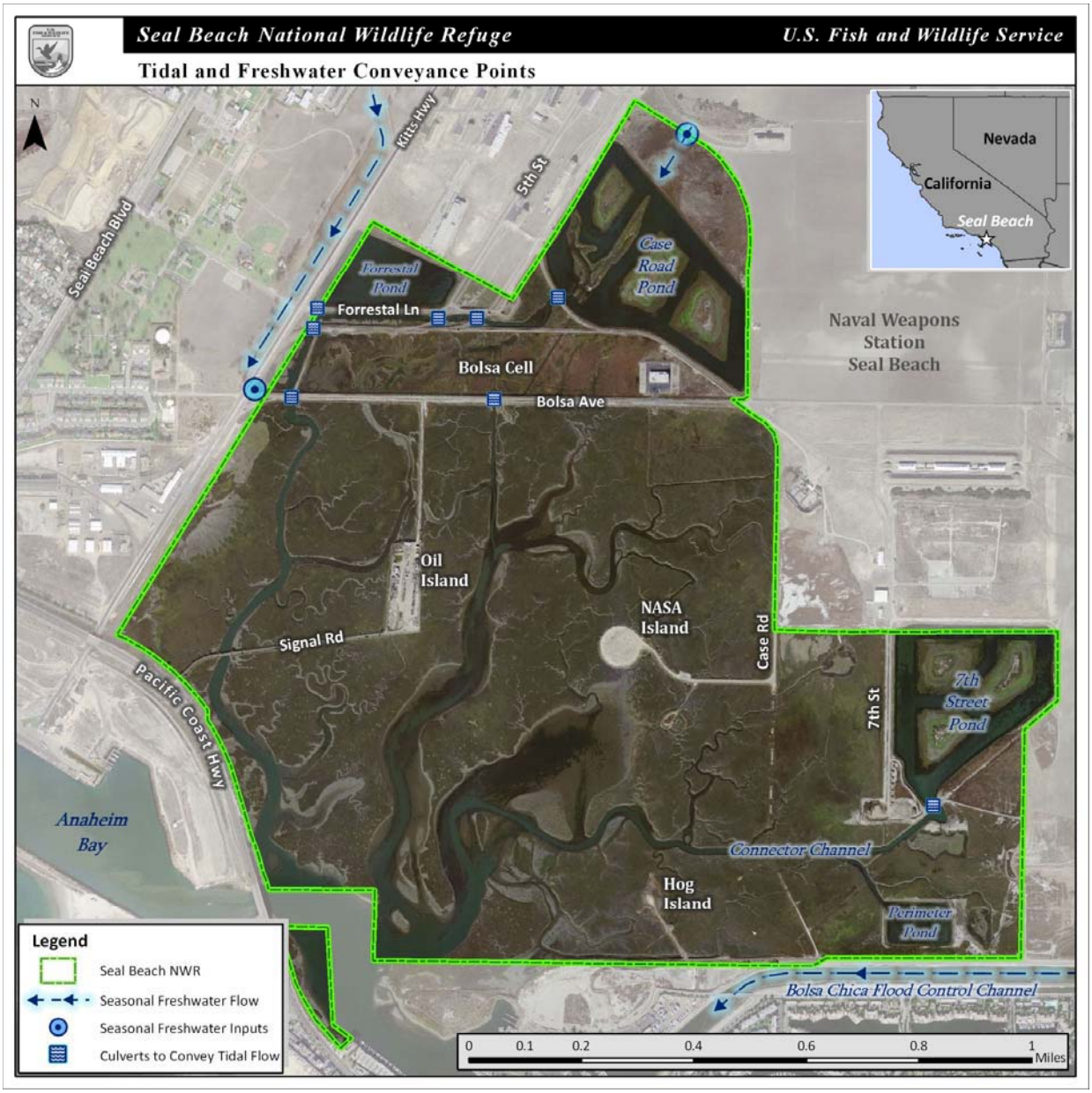

Figure 4-11. Tidal and Freshwater Conveyance Points

A 45-acre area to the north of Bolsa Avenue and south of the railroad tracks (referred to as the Bolsa Cell) was separated from unobstructed tidal influence at some point in the past by the construction of Bolsa Avenue. According to existing topography and utilities drawings prepared for the Port of Long Beach (*Moffatt and Nichol, Engineers 1988*) in preparation for developing restoration plans for various portions of the Refuge, tidal influence, although limited, was maintained within the Bolsa Cell through a series of culverts. Two 30-inch-diameter culverts (the western culverts) were identified under Bolsa Avenue about 300 feet to the east of the intersection of Bolsa Avenue and Kitts Highway, and three 30-inch-diameter culverts (the central culverts) were present under Bolsa Avenue about half way between Kitts Highway and Case Road. Despite a muted tidal range, tidal exchange in the Bolsa Cell supported, and continues to support, high marsh habitat and a large population of Belding savannah sparrows.

To avoid any impacts to the wetland habitat in the Bolsa Cell as a result of the Port of Long Beach mitigation project, restoration plans included preserving the majority of the Bolsa Cell. The restoration project did require that the western end of the Bolsa Cell be converted into a channel (referred to as the mitigation channel) to convey water from Anaheim Bay to Forrestal and Case Road Ponds. To create this 300-foot-wide channel required that the remainder of the Bolsa Cell be separated from the channel by a dike extending north from Bolsa Avenue to the railroad tracks located along the northern edge of the Cell. The mitigation channel continues to convey tidal flows from the main wetlands complex to the south of Bolsa Avenue via a series of large culverts into the restored areas in Forrestal Pond and Case Road Pond(refer to Figure 4-11). The two western culverts that had previously provided tidal exchange into the western end of the Cell were demolished. To continue to provide tidal exchange to the western end of the Cell, two 30-inch pipe culverts were placed in the new dike and the three 30-inch-diameter central culverts were retained.

Over the years, various changes have been made to the two culverts that connect the mitigation channel to the Bolsa Cell in an effort to address water levels in the Cell, as well as water quality issues. Shortly after completion of the restoration project, first one and then both culverts were sealed at the request of the Service over concerns that the water level in the Cell was too high (*Sea Dyn, Inc. 1993*). The central culverts were unaffected by this action.

In 1993, the Service once again raised concerns regarding the habitat quality in the Bolsa Cell, this time citing issues related to degraded water quality and unacceptably low water levels. Modeling of the hydraulic circulation within the Bolsa Cell concluded that the tidal range within the Cell following the sealing of the two culverts was lower than the historical range by approximately 0.9 feet (*Sea Dyn, Inc. 1993*). Based on the modeling results, which indicated that higher high tide water levels nearly identical to pre-restoration conditions might be achieved by reestablishing the connection between the Bolsa Cell and the mitigation channel, the culverts were re-opened. Although no data are currently available to verify the prediction of the 1993 modeling, the model did predict that reopening the culverts would not result in the lower low water levels that occurred in the Cell prior to restoration (*Sea Dyn, Inc. 1993*). These lower low water levels could only be achieved by restoring a direct connection between the Bolsa Cell and Anaheim Bay, which would require installing new culverts under Bolsa Avenue near the western end of the Bolsa Cell.

Even after the culverts were reopened, the Bolsa Cell continues to experience fluctuations in tidal flow and water quality due to biofouling (the accumulation of mussels within the culvert) and pipe corrosion. Biofouling has restricted tidal flow through the culverts which in turn has resulted in a lower tidal range and degraded water quality. Water levels and water quality are restored once the culverts are clean out. Currently, the culverts are in very poor condition, showing significant signs of deterioration. This is resulting in tidal seepage around the culverts, which could ultimately

lead to a breach in the dike that separates the Bolsa Cell from the mitigation channel. The condition of the culverts at the center of the Cell is currently unknown.

To provide adequate tidal exchange between the existing main wetlands complex and the two eastern restoration sites, 7th Street Pond and Perimeter Pond, the southernmost tidal channel in the main wetlands complex was extensively modified. The main length of this east/west aligned channel from just northeast of Hog Island to a point to the southeast of the terminus of 7th Street was widened, and a new connector channel was dredged from the main channel southeast to the proposed site of Perimeter Pond (refer to Figure 4-11). In addition, a box culvert was installed at the south end of the 7th Street Pond to convey tidal flows from the modified channel under an existing unpaved access road and into the 7th Street Pond.

Shortly after construction, concerns were also raised regarding the high velocities observed during incoming and outgoing tides in the vicinity of the box culvert installed at the south end of the 7th Street Pond. An extreme hydrodynamic condition known as a vortex was observed in the area during times when high speed water currents were being drawn through the submerged culvert. This condition, which continues today, was evaluated during the five-year monitoring period for the Port of Long Beach mitigation project. The extreme vortex formation occurring adjacent to the 7th Street Pond culvert, as well as erosion occurring in some of the created tidal basins and around associated culverts was evaluated during this monitoring period (*Sea Dyn, Inc. 1993*). The vortex formation was a concern because of the adverse effect it was having on diving birds. To eliminate or reduce the strength of the vortices forming at the 7th Street Pond culvert, the study recommended installing flow vanes within the existing culvert wing walls. The flows vanes would consist of steel plates bolted onto the culvert (*Sea Dyn, Inc. 1993*). The results of this analysis indicated that altering the culvert in this manner would not be expected to impact the current tidal flow into and out of the 7th Street basin; however, the channel slope located opposite of the culvert would likely have to be armored. No actions have been implemented to date to address this issue, and prior to considering this or any other alterations, additional modeling and analysis would be conducted to more fully understand the potential effects to existing hydraulic conditions and the surrounding habitat, as well as to large fish, marine mammals, sea turtles, and other marine organisms traveling through the existing culvert.

Tidal current, water levels, and habitat areas were monitored by MEC Analytical Systems, Inc. between March 16, 1990 to December 18, 1990 and March 27, 1992 to October 7, 1992 (*MEC 1995*). Monitoring of tidal currents revealed that the currents were high enough to cause sediment transport throughout the channel system in the restored areas, as well as local scour in the vicinity of the culverts. The subsequent 1993 erosion study (*Sea Dyn, Inc. 1993*) concluded that scour in the 7th Street basin and the associated supply channel appeared to have reached equilibrium and that scour opposite the culvert exit will probably continue, but at a much slower and diminishing rate. The 1993 report also concluded that "given the present equilibrium state, no slope protection measures are appropriate at the present time. However, if any changes are made to the tidal response of the basin or the flow field around the culvert, slope protection measures may be required" (*Sea Dyn, Inc. 1993*). Periodic visual inspection of the slopes was recommended.

Erosion and scour processes within the restoration area were once again analyzed in late 2006 and early 2007 by Everest International Consultants, Inc. (*2007*) due to continued concerns about the stability of the slopes and channels in the restored area. Everest concluded that erosion continues to occur within the restoration area and that erosion appears to have expanded to areas that were not identified as problems in prior reports. A previously undocumented flow vortex was also observed in the vicinity of the large culvert that conveys tidal waters from the main marsh complex under Bolsa Avenue and through the Bolsa mitigation channel to the Forrestal Pond and Case

Road Pond. Based on these observations and an analysis of the results of previous studies conducted on the site, Everest recommended that the Refuge establish an annual monitoring program to quantify the rate of erosion throughout the restored areas in terms of impacts to habitat and infrastructure.

The causes for the erosion observed on the Refuge were categorized into three groups: 1) current induced scour causing undercutting and slope failure, 2) wind wave induced undercutting leading to slope failure, and 3) bioturbation (e.g., burrowing from squirrels) in combination with other causes (*Everest 2007*). Current induced scour occurs when the shear stress at the water/sediment interface exceeds critical values for the existing sediment. On the Refuge, this process was observed in locations where high water velocities occur near eroded banks. At various tidal stages the currents are fastest during flooding and ebbing conditions, removing sediment particles along the bank. This undercuts the lower portion of the bank leading to upper slope failure. Locations within the Refuge impacted by current induced scour include: the dike that separates the Bolsa Cell from the constructed tidal channel and the area to the southeast of the 7th Street Pond. Potential remedial measures include flow realignment, channel recontouring, armoring (riprap and/or concrete units), and biotechnical stabilization (*Everest 2007*).

Another potential cause of erosion comes from wind waves, which develop through the interaction of wind on the surface of open water, increasing with the wind speed and length of interface with the water surface. The normal wind condition on the Refuge, as measured at Sunset Marina Harbour, is characterized by winds from the south and southwest at greater than 10 knots beginning at 11AM and continuing until dusk (*Everest 2007*). This process is causing erosion in the northeast corner of Forrestal Pond. Here, the afternoon southwest winds blow directly across the open water of the pond creating waves that lap up against the north and east banks. These waves loosen bottom material and redistribute it off the bank resulting in undercutting and ultimately slope failure. No high speed water currents or current induced erosion were observed in this area. Other areas impacted by wind waves are the southwest edge of NASA Island and the eastern edge of the 7th Street Pond. Possible remedial measures include bank recontouring, armoring (riprap and/or concrete units), and biotechnical stabilization.

Biota, hydrology, tidal channel geometry, and geologic structure all contribute to the competing processes of sediment erosion and deposition within main marsh complex. These systems naturally tend to be more depositional with low velocity flow in tidal channels and over the marsh. This results in the gradual accumulation of finer-textured, highly organic sediment within the channels and adjacent marsh plain. Further deposition normally occurs from the network of tidal channels delivering sediment and nutrients to the wetland surface from the ocean. However, research shows that over the past 100 years, the Anaheim Bay system has experienced a net loss of sediment (*U.S. Navy 2011*). Possible reasons for this net loss of salt marsh sediment include the loss of sediment deposition from fluvial sources (i.e., almost complete elimination of freshwater storm flows into the system) and the periodic dredging of the harbor area and trunk channel, which prevents ocean-derived sediments from being transported into and deposited within the upper reaches of Anaheim Bay.

4.2.5.2 Water Quality

Water quality in intertidal wetlands is influenced by the level, range, and/or timing of water temperature, salinity, pH, nutrients, oxygen availability, and turbidity, as well as the frequency and timing of tidal mixing and flushing (*U.S. Navy 2011*). The ebb and flow of the tides within Anaheim Bay circulate and mix ocean and salt marsh waters, and transport nutrients and organisms in and out of the system. The tides produce currents, induce small, localized changes in

salinity, and alternately expose mudflats and adjacent shorelines. Tidal flushing is an important factor in dispersing pollutants, maintaining water quality, and moderating water temperature. In an unaltered salt marsh system, salinity in the marsh can vary significantly depending upon the amount of freshwater that flows into the marsh during storm events. As discussed above, the system has been disturbed to the point that freshwater flows into this marsh are extremely low, which can affect the quality of some vegetation. Salinity, temperature, dissolved oxygen, and turbidity data were first collected and recorded in Anaheim Bay in 1969 when monthly sampling occurred at one station within the marsh (*Chan and Lane in California Department of Fish and Game 1975*). This site was located to the south of Bolsa Avenue and the west of the Oil Island access road. In January 1970, three additional stations were added within the north, central, and south sections of the middle tidal channel that extends north/south through the main marsh complex. By December 1970, a total of 15 sampling stations were established to include the west, middle, and east tidal channels, as well as areas of cordgrass-dominated salt marsh (*Chan and Lane in California Department of Fish and Game 1975*).

Sampling results indicate considerable daily and seasonal fluctuations in water temperature within the marsh complex, due in large part to average channel depths of approximately two to three meters at high tide. During this study, the maximum and minimum monthly mean water temperatures in the marsh were 23.7° Celsius (74.7° Fahrenheit) in the summer and 12.4° Celsius (54.3° Fahrenheit) in the winter (*California Department of Fish and Game 1975*). A fluctuation in water temperature due to tidal influx was also observed, with temperature fluctuations of 1 to 3° Celsius (1.8 to 5.4° Fahrenheit) often observed. In general, water temperatures in the higher elevations of the marsh were cooler in the winter and warmer in the summer than in the lower elevations of the marsh (*California Department of Fish and Game 1975*).

In addition to changes in temperature over time, water temperature also varies within the water column. This is most notable in the summer, when surface temperatures are approximately 0.5° Celsius (0.9° Fahrenheit) warmer than the temperatures at the bottom of the water column (*U.S. Navy 2011*). These seasonal temperature fluctuations are greater in the higher marsh elevations where water levels are generally very shallow.

Data collected in the 1970s indicated an average salinity in the marsh between May and October of between 34.2 and 34.5 parts per thousand (ppt), slightly higher than the salinities recorded in the outer harbor of Anaheim Bay, which ranged from 33.5 to 34 ppt. Once the rainy season began surface water salinity levels dropped and were often recorded at less than 30 ppt (*California Department of Fish and Game 1975*); however, high salinity levels were recorded below the surface. Salinity data were also collected between 1990 and 1992 as part of the monitoring effort for the Port of Long Beach mitigation project. Thirteen tidal wetlands at the four mitigation sites and one reference site (located within the main marsh complex, between NASA Island and Hog Island) were sampled between June and November 1990 and then bimonthly through July 1992. Salinity of surface water ranged from 22.2 to 34.3 ppt, and bottom water salinity levels ranged from 29.11 to 34.22 ppt (*MEC 1995, Navy 2011*).

Dissolved oxygen data collected during the 1970s study included a uniform vertical oxygen distribution in the marsh's tidal channels. Seasonal variation was small, with dissolved oxygen levels at about 6 to 8 milligrams per liter (mg/l) in the summer months and 7 to 11 mg/l in the winter months (*California Department of Fish and Game 1975*). Dissolved oxygen values recorded between 1990 and 1992 for the Port of Long Beach reference site ranged from 10.2 mg/l in the winter of 1990-1991 to a low of 3.7 mg/l the following May. On average, the dissolved oxygen concentration exceeded 5 mg/l throughout the water column during each survey (*MEC 1995*).

Water quality in Anaheim Bay is also influenced by past and present activities within the watershed. Throughout the Santa Ana River Basin, urban development, streambed alteration, and the removal of native vegetation from the floodways and floodplains have impacted water quality within the primary drainage channels, as well as within downstream bays and estuaries. Two major control channels, the Bolsa Chica channel and the East Garden Grove-Wintersburg channel, drain into the Anaheim Bay/Huntington Harbour Complex. Water quality in Anaheim Bay is affected by the storm water and urban runoff carried downstream within these two major flood control channels. It is also affected by boats and boating related activities, atmospheric deposition, agricultural runoff, and the loss of historical inputs (*County of Orange 2000*).

In 1989, the California State Legislature established the Bay Protection and Toxic Cleanup Program. This program has four major goals: 1) protect present and future beneficial uses of the bays and estuarine waters of California; 2) identify and characterize toxic hot spots; 3) plan for toxic hot spot cleanup or other remedial or mitigation actions; and 4) develop prevention and control strategies for toxic pollutants that will prevent creation of new toxic hot spots or the perpetuation of existing ones within the bays and estuaries of the State. The Regional Toxic Hot Spot Cleanup Plan for the Santa Ana River Basin (*Santa Ana RWQCB 1998*), which provides direction for the remediation or prevention of toxic hot spots in the Santa Ana Region, identifies portions of Anaheim Bay as candidate toxic hot spots for sediment toxicity. This cleanup plan defines toxic hot spots as areas in enclosed bays, estuaries, or adjacent waters where the contamination affects the interests of the state and where hazardous substances have accumulated in the water or sediment to levels which 1) pose a substantial present or potential hazard to aquatic life, wildlife, fisheries or human health; 2) adversely affect the beneficial uses of bay, estuary or ocean waters as defined in water quality control plans; or 3) exceed adopted water quality or sediment quality objectives (*Santa Ana RWQCB 1998*).

The candidate toxic hot spots in Anaheim Bay include four sites within the Refuge and an additional site that is located within NWSSB. Specific information regarding each of these sites is provided in Table 4-2. Toxic hot spots are ranked based on the degree to which they impact human health and aquatic life; how often established water quality objectives are exceeded; and the likelihood that the site could improve without intervention. A work plan for cleanup of these problem areas is partly implemented through the Bay Protection and Toxic Cleanup Program (mandated under California Water Code Sections 13390-13396). In addition, Anaheim Bay (inland of Pacific Coast Highway) and Huntington Harbour are both designated as no discharge areas for vessel sanitary wastes. Pump out facilities are in place throughout Huntington Harbour to facilitate compliance (*Santa Ana RWQCB 1995*). The County of Orange's general stormwater permit also requires the implementation of best management practices (BMPs) and other measures in the watershed to control the introduction of pollutants into the watershed to the maximum extent practicable.

Water quality issues in and around Anaheim Bay are addressed in the Water Quality Control Plan (Basin Plan) for the Santa Ana River Basin (*Santa Ana RWQCB 1995*). The State Water Resources Control Board (SWRCB) and the Santa Ana Regional Water Quality Control Board (RWQCB or Regional Board) are responsible for the protection and, where possible, the enhancement of the quality of the waters within the Santa Ana River Basin, including Anaheim Bay and Huntington Harbour. The Basin Plan for the Santa Ana River Basin, which forms the basis for the Regional Board's regulatory programs, establishes water quality standards for the ground and surface waters of the region. The term "water quality standards," as used in the Clean Water Act, includes both the beneficial uses of specific water bodies and the levels of quality which must be met and maintained to protect those uses. In order to evaluate whether water quality is adequate in a specific location, the Basin Plan identifies specific thresholds for designated

"beneficial uses." The following beneficial uses are identified in the Basin Plan for Anaheim Bay: contact and non-contact recreation; navigation; biological habitat of special significance; wildlife habitat; rare, threatened or endangered species habitat; fish spawning; and marine habitat.

Table 4-2
Candidate Toxic Hot Spots in and around Anaheim Bay

Water Body	Segment Name	Site Identification (Latitude/Longitude)	Reason for Listing	Constituents of Concern (Pollutants Present)
Anaheim Bay	Naval Reserve	33,44,12N/118,05,31 W	Sediment toxicity	Chlordane, DDE
Seal Beach NWR	Navy Marsh	33,43,88N/118,04,72 W	Sediment toxicity	DDE
Seal Beach NWR	Bolsa Avenue	33,44,65N/118,04,66 W	Sediment toxicity	Arsenic
Seal Beach NWR	Middle Reach	33,44,44N/118,04,40 W	Sediment toxicity	Arsenic
Seal Beach NWR	Left Reach	33,44,26N/118,05,18 W	Sediment toxicity	Unknown
Huntington Harbour	Upper Reach	33,42,80N/118,03,67 W	Sediment toxicity	Chlordane, DDE, Chlorpyrifos

Source: (*Regional Water Quality Control Board Santa Ana Region 1998*)

The Basin Plan also includes an implementation plan that describes the actions that are necessary to achieve and maintain specific water quality objectives (*Santa Ana RWQCB 1995*). The Basin Plan's (*Santa Ana RWQCB 1995*) water quality objectives for Anaheim Bay and the other enclosed bays and estuaries within the Santa Ana River Basin address algal growth, total coliform, residual chlorine, color, floatables, oil and grease, dissolved oxygen, pH, radioactivity, suspended and settleable solids, sulfides, surfactants, taste and order, temperature, toxic substances, and turbidity. The 1995 Basin Plan identifies Anaheim Bay as a known toxic hot spot for cadmium, copper, lead, and chromium and a potential toxic hot spot for aldrin, chlordane, lindane chlorbenside, PCBs, DDT, chlorpyrifos, endosulfan, heptachlorepoxide, and hexachlorbenzene.

Section 305(b) of the 1972 Clean Water Act requires the State of California to prepare and submit to the U.S. Environmental Protection Agency (USEPA) a report on the status of the state's ambient water quality. This report includes regional water quality assessments (WQA) for the various water bodies within the state. The WQA lists the water bodies that are assessed, the pollutants of concern, and the potential pollutant sources. Water bodies identified in the 305(b) report as not supporting one or more beneficial uses are considered "impaired" and are then placed on the Clean Water Act Section 303(d) list of impaired water bodies. Once included on the 303(d) list, the Clean Water Act requires that total maximum daily loads (TMDL) be developed to address the parameters responsible for impairment.

In 1991, Anaheim Bay was listed as a Clean Water Act Section 303(d) Impaired Water Body for toxic metals and pesticides, while the adjoining Huntington Harbour was listed for bacteria, toxic metals, and sedimentation (*California Water Boards 2007*). The listing was based on California's statewide Mussel Watch data collected prior to 1991. The Mussel Watch program, which is implemented to detect and evaluate the occurrence of toxic substances in marine waters, identified levels of lead, cadmium, selenium, DDT, chlorobenzenes, and lindane above elevated data levels

(EDL) in the tissue of mussels placed in Anaheim Bay for the purposes of the study (*California Water Boards 2007*). The Mussel Watch data for Huntington Harbour showed levels of lead, chromium, aldrin, chlordane, DDE, DDT, endrin, and heptachlor above EDL. These data, although an indication of the present of toxics, do not provide adequate information to determine if beneficial uses within the water bodies are being impacted. As a result, a thorough toxicity study of Anaheim Bay and Huntington Harbour was initiated in 2001.

In 2007, the Santa Ana Regional Water Quality Control Board released the results of the Anaheim Bay and Huntington Harbour Sediment and Water Column Toxicity Study (*California Water Boards 2007*), initiated in 2001. The goal of the study was to attain a comprehensive and current assessment of the ambient water and sediment quality in the Anaheim Bay/Huntington Harbour Complex and to establish baseline conditions for the area. The monitoring design involved a stratified-random sampling design with a spatially systematic component that prevented the clustering of sampling sites in an effort to achieve an unbiased representation of water quality throughout the study area. The monitoring study consisted of sampling 60 sites, 30 each in Anaheim Bay and Huntington Harbour. None of the sampling locations occurred within the Refuge boundary; however, one sampling location (#26) was situated just to the east of the Pacific Coast Highway bridge and two additional sampling sites (#3 and #29) were located to the just to the southeast of the large, central tidal channel that extends up into the Refuge (refer to Figure 4-1). The remaining sampling locations in Anaheim Bay were located to the west of Pacific Coast Highway in Anaheim Bay proper. Sampling was conducted to measure sediment chemistry, surface water chemistry, and benthic infauna. At each sample location, field measurements of the water column were taken to measure pH, dissolved oxygen, temperature, salinity, bottom depth, turbidity, and total suspended solids. The results of the field measurements of the water column for the three sampling sites located closest to the Refuge are provided in Table 4-3.

The toxicity study noted seasonal differences in the concentrations of various metals and organics in sediments collected in Anaheim Bay. These differences occurred between wet and dry months; however, a particular season was not consistently higher than the other. For example, wet season samples had significantly higher concentrations of mercury than the dry season samples. Silver concentrations on the other hand were higher in the dry season samples than in the wet season samples. Total DDT and PCB concentrations were higher in the dry season than in the wet season (*California Water Boards 2007*). In total for sampling sites near the Refuge, contaminants likely to be associated with toxicity were present in sediments at sampling location #3, but at low concentrations. The overall conclusions of the study were that Anaheim Bay supports a diverse infaunal community that does not appear to be impaired. "The sediment geochemistry and sediment toxicity analysis indicate a low probability of adverse effects" (*California Water Boards 2007*). Some seasonal effects were observed, particularly during the wet season when some sediment toxicity was observed. This wet season toxicity is likely related to increased runoff from watershed sources during the rainy season.

The Clean Water Act Section 303(d) Impaired Water Bodies list is updated about every two years. In the latest update prepared in 2006 and approved by the USEPA on June 28, 2007, Anaheim Bay was once again classified as an impaired water body on the 303(d) list. Identified pollutants or stressors include dieldrin, nickel, polychlorinated biphenyls (PCBs), and sediment toxicity. The proposed date for developing a TMDL for this water body is 2019. The adjacent Huntington Harbour is also listed in the 2006 303(d) list. The identified pollutants in this water body include chlordane, copper, lead, nickel, pathogens from urban runoff, PCBs, and sediment toxicity.

In accordance with California Water Code Section 13393, the California State Water Resources Control Board (SWRCB) has developed sediment quality objectives for toxic pollutants for

Table 4-3
Water Column Measurements for Three Locations in Anaheim Bay from August 2001 and February/April 2003

Station Location	Sampling Date	Depth (meters)	Temperature ˚C (˚F)	pH	Oxygen (mg/l)	SBE DO Saturation (mg/l)	Transmissivity (%)	Salinity (ppt)	Density
East of Pacific Coast Highway (Sample #26)	08-2001	1	21.03 (69.85)	7.68	5.46	7.31	43.1	33.4	23.3
		2	21.01 (69.82)	7.70	5.51	7.31	41.6	33.4	23.3
		3	20.86 (69.55)	7.72	5.53	7.33	41.5	33.4	23.3
		4	20.78 (69.40)	7.73	5.52	7.34	43.0	33.4	23.4
		5	20.78 (69.40)	7.74	5.50	7.34	44.6	33.4	23.4
		6	20.74 (69.33)	7.76	5.58	7.35	-15.2	33.5	23.4
	Feb/April 2003	No data	No data	No data	No data	No data	No data	No data	No data
Southeast of Main Tidal Channel (Sample #3)	08-2001	No data	No data	No data	No data	No data	No data	No data	No data
	Feb/April 2003	1	17.18 (62.92)	8.18	7.51	8.26	18.9	22.8	16.1
		2	16.80 (62.24)	8.17	7.57	8.45	22.6	30.2	21.9
		3	16.45 (61.61)	8.20	7.64	18.77	28.0	31.1	22.7
		4	16.42 (61.56)	8.21	7.97	24.60	37.7	26.9	19.5
Southeast of Main Tidal Channel (Sample #29)	08-2001	1	20.09 (68.16)	7.78	4.42	7.44	20.7	33.4	23.5
		2	19.46 (67.03)	7.81	6.23	7.52	49.4	33.5	23.7
		3	19.39 (66.90)	7.52	6.57	7.54	52.0	33.2	23.6
	Feb/April 2003	1	17.2 (62.96)	8.13	6.96	4.08	15.8	19.7	13.8
		2	16.9 (62.42)	8.14	6.83	6.31	30.1	28.0	20.1
		3	16.7 (62.06)	8.16	6.65	6.52	37.0	31.6	22.9

Source: (*California Water Boards 2007*)

California's enclosed bays and estuaries. These objectives are presented in the "Water Quality Control Plan (WQCP) for Enclosed Bays and Estuaries – Part 1 Sediment Quality" (*SWRCB 2009*), which became effective in August 2009. This first phase of the WQCP establishes the following sediment quality objectives (SQOs) for enclosed bays and estuaries: 1) pollutants in sediments shall not be present in quantities that, alone or in combination, are toxic to benthic communities in bays and estuaries of California; and 2) pollutants shall not be present in sediments at levels that will bioaccumulate in aquatic life to levels that are harmful to human health.

Part 1 of the WQCP integrates chemical and biological measures to determine if the sediment dependent biota are protected or degraded as a result of exposure to toxic pollutants in sediment. This information is then used in an effort to protect human health. Part 1 is not intended to address low dissolved oxygen, pathogens, or nutrients including ammonia; instead it focuses primarily on the protection of benthic communities. Part 2 of the WQCP will focus on the benthic community protection indicators and the development of an improved approach to address sediment quality related human health risk associated with consumption of fish tissue.

Implementation of Part 1 will involve specific indicators, tools, and implementation provisions to determine if the sediment quality at a station or multiple stations meets the narrative objectives; a description of appropriate monitoring programs; and a sequential series of actions that shall be initiated when a sediment quality objective is not met.

As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) Permit Program regulates the discharge of pollutants into waters of the United States. Regulations initially focused on controlling point sources (i.e., discrete conveyances such as pipes or man-made ditches) from sewage treatment facilities, industrial sites, and power plant outfalls. With discharges from these sources improving, regulation has expanded to include nonpoint source pollution and storm water discharge. Storm drains are now being treated as a point source of pollution and are required to be covered under a NPDES permit. The County of Orange and all of the cities in the County are under a General Municipal Stormwater Permit. The U.S. Navy, including NWSSB, is covered under the statewide General Industrial NPDES Stormwater Permit. The California State Water Board recently approved a NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities that will go into effect in July 2010. This General Permit authorizes discharges of stormwater associated with construction activity so long as the dischargers comply with all requirements, provisions, limitations and prohibitions in the permit. Covered under this General Permit are all discharges of pollutants in storm water associated with construction activity (storm water discharges) to waters of the United States from construction sites that disturb one or more acres of land surface, or that are part of a common plan of development or sale that disturbs more than one acre of land surface. Coverage under this General Permit is obtained by filing a Notice of Intent, Storm Water Pollution Prevention Plan, and other appropriate documents with the State Water Board. In some cases, a General Permit may be determined by the Regional Water Board to be inappropriate for a specific construction project, requiring the discharger to obtain an Individual Permit or apply for coverage under a more specific General Permit. To make this finding, the Regional Water Board must determine that this General Permit does not provide adequate assurance that water quality would be protected, or that there is a site-specific reason for obtaining an individual permit.

4.2.5.3 Watershed Planning

The Refuge is included within the planning area for the North Orange County Integrated Regional Watershed Management Plan (*Orange County 2009*). The plan, which is currently in draft form, presents water management objectives, as well as strategies to achieve these objectives, that

address issues related to water supply, water quality, flood control, ecosystem restoration, and climate change. The plan objectives can be summarized under the following categories:

- Protect and enhance water quality in region,
- Enhance local water supplies,
- Promote flood management,
- Enhance and maintain wetlands/coastal areas and wetland functions,
- Manage runoff and its related impacts from existing and future land uses,
- Maximize funding from state and federal sources,
- Promote and support public education programs and available information,
- Reduce invasive species and enhance and maintain habitat,
- Promote environmental justice, and
- Enhance recreational opportunities in the watershed.

The primary purpose of this Integrated Regional Watershed Management Plan is to provide for more effective collaboration among the various agencies within the planning area in order to implement multiple purpose projects that will fulfill the water related management needs of the region.

4.2.6 Climate/Climate Change/Sea Level Rise

Current Conditions. Hot, dry summers and relatively mild winters characterize the typically Mediterranean climate within north coastal Orange County. Rainfall during the winters can range from drought to torrential downpours. Average annual rainfall (measured from July to June annually) for the area in and around the Refuge is about 12 inches (*County of Orange no date*) and most of this rain occurs between the months of December and February. Annual rainfall totals can vary widely, from a low of 2.73 inches in 1960/61 to a high of 23.4 inches in 2004/05 (recorded at Los Alamitos, the closest active precipitation recording site) (*County of Orange no date*). Extremely low precipitation (2.87 inches) was also recorded in 2001/02.

Average monthly temperatures range from a low of 13.9˚Celsius (57˚ Fahrenheit) in December and January, to 23˚Celsius (73.5˚ Fahrenheit) in August. Heavy fog and low clouds – the "marine layer" – occur during winter, generally between the months of February and April. In the summer months, low clouds often persist until early afternoon, but then burn off, leaving clear skies and higher temperatures. Winds from the southwest keep these months relatively cool with occasional autumn winds from the inland deserts (known locally as Santa Ana winds) that create extremely dry, hot weather lasting from a few hours to a few days.

Climate Change. Scientific evidence acknowledges that world climate is changing as indicated by increases in global surface temperature, altered precipitation patterns, warming of the oceans, sea level rise, increases in storm intensity, changes in wind patterns, and changes in ocean pH (*Bierbaum et al. 2007, Coastal Resources Center, University of Rhode Island and International Resources Group (CRC&IRG) 2009*). This is significant because "climate is a dominant factor influencing the distributions, structures, functions and services of ecosystems" (*CCSP 2008*). Climate change, defined as any change in climate over time whether due to natural variability or as a result of human activity (*CCSP 2008*), can interact with other environmental changes to affect biodiversity and the future condition of ecosystems.

Shifts in precipitation patterns and hydrological cycles, sea level rise, and more frequent and severe weather events (e.g., storms and storm surge) are the result of the warming of air and sea. These effects are already being experienced along the world's coastal regions and are expected to

intensify in the coming years (*CRC&IRG 2009*). Changes in current climate patterns will have significant consequences for the world's coastal areas. Anticipated effects include accelerated coastal erosion and loss of land and property, flooding, saltwater intrusion, shifts in the distribution and abundance of valuable marine habitats, species and biodiversity, and the accelerated spread of exotic and invasive species (*CRC&IRG 2009*).

In California, maximum, average, and minimum air temperatures have shown an increase over the past century, with the greatest increase seen in minimum temperatures (*Anderson et al. 2008*). Precipitation on the other hand has been highly variable over this period with no statistically significant trend, and it is unknown how climate change could affect the amount, form, and timing of precipitation statewide. In southern California, temperatures are predicted to increase over time. These increases in temperature could result in extended periods of excessive heat; generally drier conditions; and an increase in the number of days in which air quality standards for ozone levels are exceeded (*Cayan in Southern California Association of Governments [SCAG] 2009*). Several of the recent climate simulations for southern California suggest that summer temperatures will increase more than those in winter, with the effects felt most significantly in the interior areas of Southern California (*Cayan in SCAG 2009*).

Climate change research and monitoring is ongoing and information about local and global climate conditions and trends continues to be expanded and updated. In a recent study, researchers found that global temperatures did not increase as quickly between 2000 and 2009 as they had in previous years (*Solomon et al. 2010*). This reduction in temperature increase appears to be the result of a ten percent decrease in water vapor in the stratosphere. The reason for this decline in water vapor is unknown; however, as a result of this decline, the rise in average global surface temperatures from 2000 to 2009 was approximately 25 percent lower than expected, with average temperatures rising only 0.1 degrees Celsius during the period, rather than the 0.14 degree increase expected because of increases in other greenhouse gases (*Solomon et al. 2010*).

<u>Sea Level Rise</u>. "Sea levels are constantly in flux, subject to the influence of astronomical forces from the sun, moon, and earth, as well as meteorological effects like El Niño" (*Heberger et al. 2009*). According to the water level data collected by a worldwide network of tidal gages, the global mean sea level is rising. Over the past century, sea level has risen nearly eight inches along the California coast (*Heberger et al. 2009*).

The Intergovernmental Panel on Climate Change (IPCC) Special Report on Emissions Scenarios reports that global average sea level has risen since 1961 at an average rate of 1.8 [1.3 to 2.3] millimeters per year (mm/yr) (0.071 [0.051 to 0.091] inches per year) and since 1993 at 3.1 [2.4 to 3.8] mm/yr (0.122 [0.094 to 0.150] inches per year). The factors contributing to these rises in sea level include thermal expansion and melting glaciers, ice caps, and polar ice sheets. The IPCC states that it is unclear whether the faster rate for 1993 to 2003 reflects decadal variation or an increase in the longer-term trend (*IPCC 2007)*.

Although global sea level rise is a well-documented phenomenon (*CALFED 2007*), predictions vary regarding the rate at which sea level will rise in the future. The IPCC report suggested that global sea level will increase by approximately 30 cm (11.8 inches) to 100 cm (39.4 inches) by 2100 (*IPCC 2001*). Rahmstorf (*2007*) suggests that this range may be too conservative and that the feasible range by 2100 could be 50 cm (19.7 inches) to 140 cm (55.1 inches). Pfeffer et al. (*2008*) suggests that 200 cm (78.7 inches) by 2100 is at the upper end of plausible scenarios due to physical limitations on glaciological conditions.

The CALFED Independent Science Board (*CALFED 2007*) has stated "the most recent empirical models project a mid-range rise this century of 70-100 centimeters (cm) (28-39 inches) with a full range of variability of 50-140 cm (20-55 inches)." This is based on modeling conducted by Rahmstorf (*2007*), who considered the relationship between global mean surface temperature and global sea-level rise in projecting sea level rise for the period 1990 through 2100. In the State of California, the California Coastal Conservancy Board has adopted a Climate Change Policy (June 4, 2009) that includes the determination that until the National Academies of Science report on sea level rise is completed, the Conservancy will consider for its purposes a sea level rise scenario of 16 inches (40 cm) by 2050 and 55 inches (140 cm) by 2100 (*Conservancy 2009*). Studies indicate that a sea level rise of 55 inches would flood approximately 150 square miles of land immediately adjacent to current wetlands, and the large sections of the Pacific coast that are not vulnerable to flooding, would be subject to accelerated erosion, resulting in a loss of 41 square miles of California's coast by 2100 (*Heberger et al. 2009*).

4.2.7 Air Quality

Seal Beach NWR is located within the South Coast Air Basin regulated by the South Coast Air Quality Management District (SCAQMD), with the nearest monitoring stations in Costa Mesa and North Long Beach. The South Coast Air Basin includes Orange County and major portions of Los Angeles, San Bernardino, and Riverside Counties. Air quality within the South Coast Air Basin is influenced by topography and climate. An atmospheric condition known as a temperature inversion frequently affects air quality within the basin. During a temperature inversion, air temperatures get warmer with increasing altitude rather than cooler. Inversions occur during the warmer months (May through October), but can occur at any time throughout the year, when descending air associated with a Pacific high-pressure cell comes into contact with cool marine air. The boundary between the layers of air represents a temperature inversion that traps pollutants below it. Inversion layers impact local air quality by inhibiting the dispersion of pollutants, which results in the temporary degradation of air quality.

Air quality in a given location is defined by the concentration of various pollutants in the atmosphere, which is generally expressed in units of parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). Pollutants are generated from a variety of sources. The most significant regional sources of ozone (O_3), nitrogen dioxide (NO_2), and carbon monoxide (CO) are automobiles and other on-road vehicles. O_3 is formed by the reaction of volatile organic compounds (VOC) and oxides of nitrogen (NOx), which are combustion products from gas and diesel engines. Other important sources of VOC are paints, coatings, and process solvents. The major sources of PM-10 particulate matter (particulate matter equal to or less than 10 microns in size) and PM-2.5 fine particulate matter (particulate matter equal to or less than 2.5 microns in size) are construction, demolition, and dust from paved and unpaved roads. A large body of scientific evidence associates air pollution exposure with a variety of harmful health effects. To protect human health, the USEPA and the California Air Resources Board have adopted ambient (outdoor) air quality standards. These Federal and State Ambient Air Quality Standards, which are provided as Appendix E, identify outdoor pollutant levels that are considered safe for the public, including those individuals most sensitive to the effects of air pollution, such as children and the elderly. These standards also provide the basis for determining the significance of a particular pollutant concentration.

The Federal Clean Air Act (42 U.S.C. §§ 7401-7671q) requires the USEPA to set outdoor air quality standards for the nation, referred to as National Ambient Air Quality Standards (NAAQS). To date, standards have been established for sulfur dioxide (SO_2), CO, NO_2, O_3, PM-10, PM-2.5, and lead (Pb). The Clean Air Act also permits states to adopt additional or more protective air quality standards if needed. Within California, the California Ambient Air Quality Standards (CAAQS)

set parameters for certain pollutants, such as particulate matter and ozone, that provide greater protection of public health than the respective Federal standards. California has also set standards for some pollutants that are not addressed by Federal standards, including sulfates (SO_4), hydrogen sulfide (H_2S), and visibility reducing particles.

Air pollution controls established by SCAQMD have had a positive impact on the Basin's air quality, but some air quality standards are still being exceeded. Orange County was declared an attainment area for NO_2 in 1998 and an attainment area for CO in June 2007. The 8-hour ozone levels have been reduced by half over the past 30 years, but the USEPA continues to identify Orange County as a severe non-attainment area for 8-hour ozone. Orange County is also designated by the USEPA as a serious non-attainment area for PM-10 and a non-attainment area for PM-2.5 (*USEPA 2008a*). In March 2008, the USEPA adopted a new 8-hour ozone standard of 0.075 ppm (the previous standard was 0.08 ppm). California's recommendations for which areas should be designated as non-attainment areas are due to the USEPA in March 2009. The USEPA is expected to make final area designations by March 2010.

To address 8-hour ozone and PM-2.5 issues, SCAQMD prepared and approved a Final Air Quality Management Plan (AQMP) for the SCAQMD in 2007. The AQMP is intended to meet both state and federal Clean Air Act planning requirements for all areas in the district, including Orange County. The AQMP, which incorporates a variety of new control strategies, requires more focused control of SOx, directly-emitted PM2.5, and NOx supplemented with volatile organic compounds (VOC) to achieve federal PM-2.5 standards. The AQMP's 8-hour ozone control strategy, which builds upon the previous PM-2.5 strategy for the district, has been augmented with additional NOx and VOC reductions in an effort to meet the federal standard. The control measures in the 2007 AQMP consist of four components: 1) SCAQMD's Stationary and Mobile Source Control Measures; 2) the California Air Resources Board's (CARB) proposed State Strategy; 3) SCAQMD staff's proposed policy options to supplement CARB's control strategy; and 4) Regional Transportation Strategy and Control Measures provided by the Southern California Association of Governments. The 2007 AQMP relies on a comprehensive and integrated control approach aimed at achieving the PM-2.5 standard by 2015 through implementation of short-term and midterm control measures and achieving the 8-hour ozone standard by 2024 based on implementation of additional long-term measures.

Conditions in the vicinity of the Refuge differ to some extent from the rest of the basin due in large part to the prevailing sea breeze which transports polluted air inland. This is particularly true for ozone. Monitoring results indicate that at no time in 2005 was the federal ozone, PM-10, or PM-2.5 standards exceeded in the vicinity of the Refuge (*SCAQMD 2007*). The local source of air pollutants near the Refuge is primarily vehicle exhaust from Pacific Coast Highway to the south and Interstate 405 (I-405) to the north. In addition, a local major point source (defined as a source generating a minimum of 100 tons per year of primary air pollutants) is the Haynes Steam Plant, located approximately one mile northeast of the Refuge (*USFWS and U.S. Navy 1990*).

In addition to monitoring regional ambient air quality, SCAQMD also evaluates and issues air quality permits to ensure that proposed new and changed operations and industrial equipment meet emission standards. Construction and operation permits are required for any operation or equipment capable of emitting air contaminants. Persons building, altering, or replacing equipment, which may emit air pollutants, are required to obtain an Authority to Construct Permit. Persons operating equipment, which may emit air pollutants, are also required to obtain a Permit to Operate.

Within the South Coast Air Basin, the SCAQMD regulates activities and man-made conditions that are capable of generating fugitive dust through Rule 403 of the SCAQMD Regulations. Fugitive dust is defined as any solid particulate matter, other than that emitted from an exhaust stack, which becomes airborne either directly or indirectly as a result of the activities of any person. The purpose of Rule 403 is to reduce the amount of particulate matter released into the air as a result of man-made dust sources by requiring actions to prevent, reduce, or mitigate fugitive dust emissions. Best available control measures and guidance for reducing dust have been developed by the SCAQMD and are available in Tables 1 and 2 of Rule 403 (*SCAQMD 2005*).

Rule 1901 (General Conformity) of the AQMD Regulations applies to Federal actions conducted within the air basin and was incorporated into the regulations in accordance with Part 51, Subpart W, Title 40 of the Code of Federal Regulations (CFR). CFR Section 51.850 states the no department, agency, or instrumentally of the Federal Government shall engage in, support in any way, or provide financial assistance for, license or permit, or approve any activity which does not conform to the applicable air quality implementation plan, in this case the SCAQMD's 2007 AQMP (*SCAQMD 2007*). In the South Coast Air Basin, a conformity determination is required for each pollutant, where the total direct and indirect emissions in a nonattainment or maintenance area caused by a Federal action would equal or exceed established rates. In nonattainment areas, the following rates apply:

Ozone (VOCs or NO_x) – 25 tons/year,
CO – 100 tons/year,
SO_2 or NO_2 – 100 tons/year,
PM-10 – 70 tons/year,
PM-2.5 direct emissions – 100/tons/year,
PM-2.5 SO_2 – 100/tons/year,
PM-2.5 NO_x – 100/tons/year,
PM-2.5 VOC or ammonia – 100/tons/year, or
Pb – 25 tons/year.

In maintenance areas, the following rates apply:
Ozone (NO_x, SO_2, NO_2) – 100 tons/year,
Ozone (VOCs) – 50 tons/year,
CO – 100 tons/year,
SO_2 or NO_2 – 100 tons/year,
PM-10 – 100 tons/year,
PM-2.5 direct emissions – 100/tons/year,
PM-2.5 SO_2 – 100/tons/year,
PM-2.5 NO_x – 100/tons/year,
PM-2.5 VOC or ammonia – 100/tons/year, or
Pb – 25 tons/year.

The requirements of Rule 1901 do not apply to Federal actions where the total of direct and indirect emissions is below these emission levels. However, when the total of direct and indirect emissions of a pollutant from a Federal action represents 10 percent or more of an area's total emissions of that pollutant, the action is defined as a regionally significant action.

4.2.8 Greenhouse Gas Emissions

There is general scientific consensus that increases in greenhouse gases (GHGs) in the atmosphere are a contributing factor to increases in average global temperatures. GHGs trap heat in the atmosphere, which in turn heats the surface of the Earth. Some GHGs occur naturally and are

emitted to the atmosphere through natural processes, while others are created and emitted solely through human activities. The emission of GHGs through the combustion of fossil fuels (i.e., fuels containing carbon) in conjunction with other human activities, appears to be closely associated with global warming (*State of California Office of Planning and Research 2008*). The USEPA and the State of California identify the principal GHGs that enter the atmosphere because of human activities as: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases (i.e., hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride). The most common GHG that results from human activity is carbon dioxide, followed by methane, and nitrous oxide.

Carbon dioxide enters the atmosphere through the burning of fossil fuels. Methane is emitted during the production and transport of coal, natural gas, and oil, and is also emitted as a result of livestock and other agricultural practices and the decay of organic waste in municipal solid waste landfills. Nitrous oxide is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste. Fluorinated gases are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes and are sometimes used as substitutes for ozone-depleting substances.

California, where the Refuge is located, is a substantial contributor of GHGs, emitting over 400 million tons of carbon dioxide a year (*California Energy Commission 2006*). Climate studies indicate that California is likely to see an increase of three to four degrees Fahrenheit over the next century. As primary GHGs have a long lifetime in the atmosphere, accumulate over time, and are generally well-mixed, their impact on the atmosphere is mostly independent of the point of emission.

The impact of anthropogenic activities on global climate change is apparent in the observational record. Air trapped by ice has been extracted from core samples taken from polar ice sheets to determine the global atmospheric variation of carbon dioxide, methane, and nitrous oxide from before the start of the industrialization (approximately 1750), to over 650,000 years ago. For that period, it was found that carbon dioxide concentrations ranged from 180 ppm to 300 ppm. For the period from approximately 1750 to the present, global carbon dioxide concentrations increased from a pre-industrialization period concentration of 280 ppm to 379 ppm in 2005, with the 2005 value far exceeding the upper end of the pre-industrial period range (*IPCC 2007*). The IPCC constructed several emission trajectories of GHGs needed to stabilize global temperatures and climate change impacts and concluded that a stabilization of GHGs at 400 to 450 ppm carbon dioxide-equivalent concentration is required to keep mean global climate change below 2°C (3.6°F).

To address GHG emissions at the Federal level, President Obama on October 5, 2009 signed Executive Order 13514 on Federal Sustainability, setting measureable environmental performance goals for Federal Agencies. Each Federal Agency was required to submit a 2020 GHG pollution reduction target from its estimated 2008 baseline to the White House Council on Environmental Quality and to the Director of the Office of Management and Budget by January 4, 2010. On January 29, 2010, President Obama announced that the Federal Government will reduce its GHG emissions by 28 percent by 2020. To achieve this goal, each Federal agency must develop a "Sustainability Plan" that defines how sustainability goals will be met, energy use will be reduced, long-term savings will be achieved, taxpayer dollars will be saved, and local clean energy jobs will be created.

In California, to avert the consequences of climate change, California Assembly Bill 32 (AB 32), the Global Warming Solutions Act of 2006, was signed into law in 2002. AB 32 establishes a state goal of reducing GHG emissions to 1990 levels by the year 2020. It also directed the California Air Resources Board (CARB) to begin developing discrete early actions to reduce greenhouse gases

while also preparing a scoping plan to identify how best to reach the 2020 limit. The CARB recently adopted a statewide 2020 GHG emissions limit and an emissions inventory, along with requirements to measure, track, and report GHG emissions by the industries it determined to be significant sources of GHG emissions. In addition, the CARB has developed a Scoping Plan that outlines California's strategies for reducing GHG emissions. In addition to the passage of AB 32, the Governor of California also set a long range reduction goal of reducing GHGs to 80 percent below 1990 levels by 2050.

4.2.9 Contaminants

With the exception of any contamination and spills associated with the oil operation on Oil Island, the Navy is responsible for the identification, assessment, characterization, and clean-up or control of contaminated sites within NWSSB, including the areas within the Refuge that were contaminated prior to establishment of the Refuge. In 1985, the Navy conducted an assessment of NWSSB, which included the Refuge, to identify sites posing a potential threat to human health or the environment that might warrant further investigation. The assessment identified eight sites within the Refuge boundary (*U.S. Navy 2011*). To address these sites, which are referred to as "restoration sites," the Navy has established an Installation Restoration (IR) program that is administered by Naval Facilities Southwest Division with regulatory oversight provide by the California-EPA Department of Toxic Substance Control and the California Water Resources Control Board, Santa Ana RWQCB. As illustrated in Figure 4-12, some of these sites are located only partially within the Refuge boundary, while others are located entirely within the Refuge. Table 4-4 provides a brief description of each site and the current status of their remediation. Of the eight sites, only three have yet to be fully remediated. For two of the sites, remediation is the responsibility of the Navy, while the third site, Oil Island, is the responsibility of the facility operator, Breitburn Energy Corporation. Possible contaminants from these three sites include lead, antimony, polycyclic aromatic hydrocarbons (PAHs), solvents, fossil fuels and derived products, asbestos, and mercury (*U.S. Navy 2011*).

Contaminants can also enter the Refuge via a variety of transport pathways involving surface water, groundwater, wind, and living organisms. Surface water enters the Refuge from adjacent Navy lands via several small drainage channels; urban runoff and storm water from upstream urban areas flows into Anaheim Bay via the Bolsa Chica channel and the East Garden Grove-Wintersburg channel; and runoff from adjacent roads such as Pacific Coast Highway and Westminster Boulevard enters Anaheim Bay via various drainage culverts. Some common pollutants that can be carried in these waters include fertilizers, pesticides, oil and grease, detergents, coolant, and paint. Groundwater transport is less likely to move contaminants from outside NWSSB, but could transport contaminants from adjacent IR sites into the Refuge's wetland areas. Wind can transport airborne contaminants such as fine particulate matter into wetland areas.

Fish, invertebrates, plants, and other organisms can also provide pathways for transporting contaminants from sediments, surface waters, and/or groundwater to other species. Fish, which are the most likely organisms to transport contaminants into the Refuge from other parts of the bay or open ocean, tend to accumulate contaminants in concentrations higher than those present in the sediments from which they were exposed. This bioaccumulation can occur through direct exposure to contaminated sediments or through dietary intake of other exposed organisms. This could put other species, such as the California least tern, at risk for exposure to contaminants because they forage on small fish that are subject to bioaccumulation.

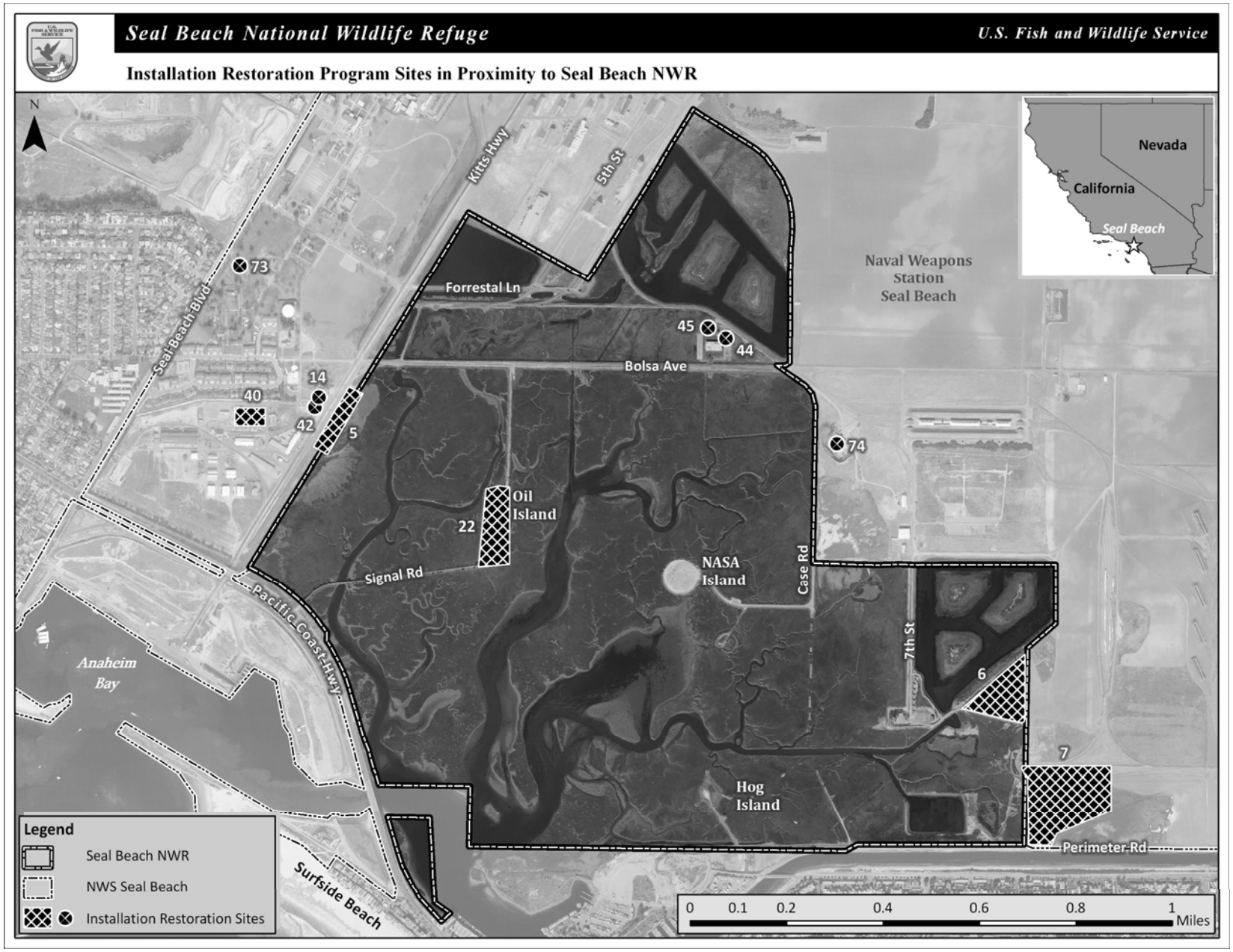

Figure 4-12. Installation Restoration Program Sites in Proximity to Seal Beach NWR

Table 4-4
Summary of Installation Restoration Program Sites
On and Immediately Surrounding Seal Beach National Wildlife Refuge

Site Number	Description	Source of Contamination and Release Period	Waste Types	Current Status
4	Unpaved perimeter road, extending along the southeast boundary of the Refuge and around eastern and northern perimeter of NWSSB	Dust control on roads; conducted from 1960s - 1973	Waste oils	Removal action implemented and groundwater monitoring completed in 2004; clean up has been completed
5	Clean fill disposal area located along the eastern edge of Kitts Highway, just to the south of the Refuge headquarters	Navy landfill used between 1943 -1944	Construction debris and fill.	Removal action implemented in 2001, groundwater monitoring completed in 2006; clean up has been completed
6	Explosives burning ground located to the southeast of the 7th Street Pond	Burned explosives from 1945 - 1971	Various types of ordnance contaminants	Work completed under IR Program
7	Station landfill located to the east of Perimeter Pond; 33-acre site located on and adjacent to the Refuge	Navy landfill used from mid 1950s - 1973	Trash, debris, solvents, oils, paint sludge, asbestos, mercury	Removal action implemented in 2004, groundwater and soil cover monitoring ongoing
14	Abandoned underground storage tanks, located off the Refuge near the Refuge office	Fuel storage 1940s-1960s	Diesel and leaded gasoline	Implementing baseline survey report monitoring
22	Oil Island, located in the southwest quadrant of Anaheim Bay, outside the Refuge boundary	Current commercial oil production area; waste holding impoundments in use in 1954	Drilling muds, oily wastes, drill cuttings	Removal action to clean up contaminated soil and groundwater is recommended; site management is implemented by the oil operator
40	Concrete pit/gravel area, located off the Refuge, west of the Refuge office	Engine work area and drainage, used from late 1940s – 1978	Oil and chlorinated solvents	Remedial action planned
42	Underground storage tank, along Kitts Highway near Refuge boundary	Waste oil tank used from 1950 – 1972	Water oil	Removal action planned for pipe discharge portion of the site, no other action planned
44	Former waste Otto fuel drum storage area, located immediately to the east of the Bolsa Cell	Drum storage yard from mid 1940s – 1970s	Waste Otto fuel	Removal action implemented for the sediment; clean up has been completed
45	Floor drain outlet, located immediately to the east of the Bolsa Cell	Floor drain impacting area through early 1980s	Unknown	Removal action implemented in 2006; clean up has been completed
74	Former skeet range, located primarily on Navy land, just south of the current small weapons range	Skeet shooting from the late 1960s – early 1990s	Lead, antimony, and PAHs	Removal action plan currently being evaluated, but not yet implemented

Source: (*U.S. Navy 2007*)

Limited sediment studies were conducted within the Refuge by the Navy in 1988 as part of the IR program. These studies identified levels of total petroleum hydrocarbons and chromium in some locations that exceeded Santa Ana Regional Water Quality Control Board designated levels for marine waters, which were set at 100 mg/kg and 20 mg/kg, respectively (*U.S. Navy 2011*). These levels may have been associated with oil drilling at Oil Island.

In 1995, a study to assess the effects of operations at NWSSB on the Refuge's salt marsh biota was conducted. The study focused on potential bioaccumulation of chemicals in species that are the primary food items of the endangered California least tern and light-footed clapper rail. Observed levels of contaminants in prey species collected in the restored ponds around the perimeter of the Refuge and within the Refuge's main tidal channels did not warrant a concern for immediate remediation (*U.S. Navy 2011*). However, contaminants in prey species were found in concentrations sufficient to potentially produce sublethal effects in the least tern and clapper rail. These contaminants included cadmium, chromium, copper, lead, nickel, zinc, dichloro-diphenyl-ethylene (DDE, a stable breakdown product of the insecticide DDT), and polychlorinated biphenyls (PCBs) (*U.S. Navy 2011*).

Another potential source of contamination is the agricultural activity occurring on Navy lands located adjacent to the Refuge. The INRMP identifies the potential for small amounts of agricultural tailwater to enter the Refuge from north of Bolsa Avenue, and Refuge staff has observed significant amounts of rainwater runoff entering the Refuge from the agricultural lands near the corner of Case Road and Bolsa Avenue. Tailwater and runoff could transport trace amounts of pesticides and/or fertilizers into the marsh, as well as residual DDT and DDE that persists in the soil as a result of past agricultural practices.

4.3 Biological Resources

4.3.1 Regional and Historical Context

Coastal southern California includes a unique combination of physical features, climate, and hydrology that have resulted in a diversity of plants and wildlife unlike any other region in North America. Southern California also has the dubious distinction of having more species listed as threatened or endangered than any other region in the continental United States (*USFWS 2006*). The habitats in Seal Beach NWR support two federally listed species, including the endangered California least tern and light-footed clapper rail. The Refuge also supports the state endangered Belding's savannah sparrow. The coastal wetland habitats protected within this Refuge are essential to the migratory birds of the Pacific Flyway, as these habitats provide opportunities for resting and feeding with minimal potential for human disturbance. The site also provides significant nesting habitat for California least terns, which migrate north into southern California in the spring from Mexico to mate and raise their young. Seal Beach NWR benefits from being situated within the Southern California Bight, a distinct bioregion of California that includes the marine-coastal interface and extends inland to include the coastal wetlands and watersheds of southern California. The Bight's embayments, which include Anaheim Bay, and its marshes and estuaries, are among the most productive habitats on the Pacific Coast. Unfortunately, estimates by the Southern California Coastal Wetland Inventory prepared by the California Coastal Conservancy indicate that less than 30 percent of the wetlands that once occurred within the Bight are still present today. As a result, the coastal habitats that do remain within the Bight are of regional significance because of the many wetland dependent organisms supported by these habitats.

At present, there are approximately 40 areas of salt marsh habitat (representing a combined total of 12,000 acres) located along the Southern California Bight between Point Conception and just south of the Mexican border (including the Channel Islands) (*U.S. Navy 2011*). Many of these coastal wetlands are either permanently closed or frequently closed to tidal influence primarily as a result of human disturbance. Anaheim Bay is one of the wetland systems that remains permanently open to tidal flushing, which increases the significance of this wetland within the region. As a result of daily tidal flushing, this wetland supports a high diversity of salt marsh plant species, including a number of low marsh species, such as cordgrass, annual pickleweed (*Salicornia bigelovii*), and saltwort (*Batis maritima*), that are generally absent from nontidal wetland systems. Similarly, this site likely supports a greater diversity of fish and benthic organisms that in turn support a diverse and abundant array of migratory and resident birds and larger marine organisms. The inclusion of the Refuge within a military facility ensures minimal human disturbance to the migratory birds and other resident waterbirds supported on the Refuge. Maintaining such a protected site along the Orange County coast is important because of the limited number of coastal wetland complexes remaining and the level of disturbance occurring within several of these areas.

In the 1890s, over 12,300 acres of salt marsh, tidal channel, mudflat, and salt pan habitat occurred along the Orange County coastline. Today, only seven remnants of these much larger wetland complexes remain. Some of these remaining wetland areas, such as the Anaheim Bay marsh complex and Upper Newport Bay, although reduced in size, still retain a general sense of their historic configuration. Other areas, such as Bolsa Chica, the Hellman Ranch wetlands, and the Huntington Beach wetlands have been or are currently part of extensive restoration actions; while portions of the Los Cerritos and Banning Ranch wetlands are in need of restoration to improve habitat quality and remediate years of human impacts to these historic wetland areas. Although these wetlands are not connected, together they represent a significant resource for the tens of thousands of migratory birds that forage, nest, and winter along the southern California coast, as well as for the array of marine organisms, particularly fish, that live along the coast and use these areas for foraging and nursery areas.

In 1876, the area from what is now Seal Beach Boulevard southeast to Warner Avenue and from about the location of Pacific Coast Highway to just north of Forrestal Avenue consisted of an expansive salt marsh plain crossed by estuaries, rivulets and shallow tidal basins (refer to Figure 4-3). Today, the Anaheim Bay-Huntington Harbour wetland area, which encompasses approximately 1,255 acres, is all that remains of the estimated 2,300 acres of the historical wetlands that were mapped at this location in 1876. Approximately 748 acres of these remaining wetlands are protected within the Seal Beach NWR. The events that led to the loss of a large portion of the historical Anaheim Bay wetlands are summarized in Section 4.1.1.

4.3.2 Regional Conservation Planning

4.3.2.1 Ecoregion/Landscape Conservation Cooperative Planning

Seal Beach NWR is located within the Southern California Ecoregion, as designated by the Service. This ecoregion includes distinct coastal and desert components, a rare combination of diverse habitat types, and one of the Nation's highest concentrations of threatened and endangered species.

Seal Beach NWR is also included within the California LCC, which is divided into several subunits. The Coastal Southern Subunit, in which Seal Beach is included, covers the coastal mountain ranges of central California, southern California and northern Mexico, lands between the Mojave Desert

and the Pacific Ocean, and numerous offshore islands. The California LCC will provide a forum for information exchange and feedback among partners and, secondarily, among other interested parties (e.g., organizations, scientists, and managers).

4.3.2.2 Applicable Species Recovery Plans

The Service has prepared recovery plans for the federally listed species that occur or historically occurred on the lands included within the Refuge. These recovery plans, which include the California Least Tern Recovery Plan (*USFWS 1985a*), Salt Marsh Bird's-Beak (*Cordylanthus maritimus maritimus*) Recovery Plan (*USFWS 1985b*), and Light-footed Clapper Rail Recovery Plan (*USFWS 1985c*), are intended to serve as guidance documents for agencies, landowners, and the public. Each plan includes recommendations for actions considered necessary to satisfy the biological needs and assure the recovery of the listed species. These plans also emphasize opportunities for improved management of listed species on Federal and state lands. Recommended actions generally include protection, enhancement, and restoration of those habitats deemed important for recovery, monitoring, research, and public outreach.

The recommendations provided in the recovery plans for those listed species that occur or have historically occurred on the lands included within the Refuge have been considered during the development of the CCP. Recommendations specific to the Seal Beach NWR are reflected in the CCPs goals, objectives, and strategies.

4.3.2.3 Shorebird Conservation Planning

The Seal Beach NWR is located within the Southern Pacific Shorebird Planning Region, as defined by the U.S. Shorebird Conservation Plan (*Brown et. al. 2001*). The Southern Pacific Region is an important wintering area for shorebirds that breed in the arctic and temperate zones, but is also important during migration, particularly for arctic breeding species traveling long distances between their wintering and breeding grounds. There are also important breeding populations in the region. The major regional goal of the U.S. Shorebird Conservation Plan is "to ensure that adequate quantity and quality of habitat is identified and maintained to support the different shorebirds that breed in, winter in, and migrate through each region." A critical management activity identified in the Shorebird Plan for the Southern Pacific Region is increasing the area and quality of tidal wetlands along the southern Pacific coast.

The Southern Pacific Shorebird Conservation Plan (*Hickey et al. 2003*) includes several priorities for conservation of shorebird populations that are relevant to Seal Beach NWR. These include increasing or maintaining the breeding populations of the black-necked stilt, American avocet, and killdeer by restoring, enhancing, or creating nesting habitat; and increasing migratory and wintering populations of all key shorebird species in the region using various protection, restoration, enhancement, and management strategies. Refuge-related general habitat goals in the Shorebird Plan include restoring tidal flats and marshes on the southern California coast; enhancing tidal action in existing wetlands as needed; and limiting human disturbance to shorebirds in all seasons.

The Shorebird Plan acknowledges Seal Beach NWR as a "wetland of importance on the California coast." Thousands of shorebirds are supported on the Refuge during migration and/or throughout the winter. In addition, a few species, including black-necked stilt and killdeer, regularly nest within the Refuge.

The Shorebird Plan identifies the following priority conservation actions for the Refuge:

- Reduce human disturbance.
- Reduce predation pressure on nesting birds.
- Protect and restore adjacent historic coastal wetlands and protect high tide roosting areas to benefit shorebirds.
- Expand the Refuge by 200 acres through acquisition of adjacent wetland habitat; and enhance the acquired habitat for nesting, migrating, and wintering shorebirds.

4.3.2.4 Waterbird Conservation

The North American Waterbird Conservation Plan (*Kushlan et al. 2002*) provides a continental-scale framework for the conservation and management of 210 species of waterbirds, including seabirds, coastal waterbirds, wading birds, and marshbirds. Seal Beach NWR is located in Bird Conservation Region #32 (Coastal California).

Eighty percent of the species addressed in the Waterbird Plan are colonial nesters. Of this group, approximately one third of the species are considered to be at risk of serious population loss. Many non-colonial waterbirds are also considered at risk. Threats to these species include habitat loss (e.g., destruction of coastal wetlands), introduced predators and invasive species, pollutants, human disturbance, and conflicts among species.

The habitat goal for this plan is "to protect, restore, and manage sufficient high quality habitat and key sites for waterbirds throughout the year to meet species and population goals." Five species known to occur on the Refuge are identified as high concern species in the Waterbird Plan: black skimmer (*Rynchops niger*), least tern (*Sternula antillarum*), snowy egret (*Egretta thula*), little blue heron (*E. caerulea*), and tricolored heron (*E. tricolor*). Although both the little blue heron and tricolored heron have been observed on the Refuge, these observations are rare and are considered unusual occurrences.

4.3.2.5 Sonoran Joint Venture Bi-national Bird Conservation

The Sonoran Joint Venture (SJV) is a partnership of diverse organizations and individuals from the southwestern United States and northwestern Mexico who share a common commitment to bird conservation. The SJV region includes much of Arizona, southern California, the Mexican states of Sonora, Sinaloa, Baja California, and Baja California Sur, and the Gulf of California and its endemic-rich islands. The Seal Beach NWR occurs within the boundaries of the SJV.
The mission of the SJV is to protect, restore, and enhance bird populations and habitats in the southwestern United States and northwestern Mexico through collaborative partnerships. The steps to achieving this mission are addressed in the SJV Bird Conservation Plan, which provides the biological foundation for the bird conservation activities of the SJV. The SJV is divided into four ecological Regions, each of which has unique habitats, birds, and conservation issues. The Seal Beach NWR is located within the Californian Coast and Mountains Region. This region, in addition to its coastal scrubland, chaparral, and various forest types, includes critically important coastal wetlands. Orange County coastal wetlands, which include Anaheim Bay, are identified in the plan as a focus area (i.e., a location identified as having significant bird populations and habitat values, and/or the potential to be restored to a condition that supports bird populations).

Of the various priority species identified for the Californian Coasts and Mountains Region, the Refuge supports 29 species of continental concern, 17 species of regional concern, and five stewardship species. Of the 43 priority species listed for coastal wetlands, the Refuge supports 37 of these species during some part of the year.

4.3.2.6 Marine Protected Areas

Marine Protected Areas (MPAs) are defined by Section 2(a) of Executive Order 13158 as "any area of the marine environment that has been reserved by the Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein" (65 *Federal Register* 34909, May 26, 2000). MPAs may be established by Federal, State, or local governments to protect marine habitats and natural and cultural resources from overexploitation, destructive uses, or other threats, or to conserve species, habitat, or biological diversity. They may also be created to provide valuable opportunities for recreation, enjoyment, and study. The Seal Beach NWR is included on the marine managed areas inventory, which will be used to form a pool of sites that may later be considered for the list of MPAs. However, inclusion on the inventory does not necessarily mean that the site would ultimately become a MPA.

4.3.2.7 California Wildlife Action Plan

The California Wildlife Action Plan (*California Department of Fish and Game 2007*) identifies the species and habitats at greatest risk in California; describes the major stressors affecting wildlife and habitats; and presents statewide and regional conservation actions needed to restore and conserve ecosystems and wildlife populations.

Seal Beach NWR is located within the South Coast Region as designated by the Action Plan. The South Coast Region is acknowledged as one of the world's hotspots for biological diversity. It is home to a total of 476 vertebrate animal species – 287 birds, 87 mammals, 52 reptiles, 16 amphibians, and 34 fish – about 38 percent of all the vertebrate species found in California. Of these species, 14 are endemic to the South Coast Region (that is, found nowhere else in the world), and 14 other species found here are endemic to California. With regard to invertebrates, 43 taxa are included on California's Special Animals List, including 38 arthropod taxa and five mollusk taxa. Of these, 29 are endemic to the South Coast Region, and nine other taxa found here are endemic to California but not restricted to this region.

The South Coast Region is also marked by massive population growth and urbanization that have transformed the landscape since the 1940s. The juxtaposition of outstanding biological resources and urbanization on a vast scale has made the South Coast Region the most threatened biologically diverse area in the continental United States. More than 150 vertebrate animal species (of the 476 total vertebrates) and 200 species of plants are either listed as protected or considered sensitive by wildlife agencies and conservation groups.

Conservation actions that apply to the management of the Seal Beach NWR include:

- protect and restore the best remaining examples of coastal wetlands that provide important wildlife habitat;
- provide greater resources and coordinate efforts to eradicate or control existing occurrences of invasive species and to prevent new introductions;
- consider the most current projections of the effects of global warming;
- give greater priority to wildlife and natural resources conservation education; and
- provide sufficient protection for sensitive species and important wildlife habitats on public agency lands, and ensure adequate funding and staffing to protect important resources.

4.3.3 Habitat and Vegetation

The Seal Beach NWR protects most of what remains of historical Anaheim Bay. Technically, today the "bay" is not a bay at all; rather it consists of a man-made inner and outer harbor and the remnants of a much larger salt marsh complex (*CDFG and UFWS 1976*). The majority of the 965

acres within the Refuge support habitats historically found along the southern California coast, with much of the site falling under the estuarine intertidal or estuarine subtidal habitat classification per the National Wetlands Inventory (*USFWS 2009*). As indicated in Figure 4-13, approximately 740 acres within the Refuge are subject to regular, unobstructed tidal influence, supporting 565 acres of coastal salt marsh vegetation, 60 acres of intertidal mudflats, and 115 acres of tidal channels and open water. Another 160 acres of the Refuge have been restored, providing a combination of coastal salt marsh, mudflat, and subtidal habitats. Although these restored areas are subject to regular tidal flushing, the tidal regime within these areas is muted. The remaining ±65 acres of the Refuge have either been developed or support disturbed upland habitat consisting primarily of non-native grasses and weeds. The approximate acreage of each habitat type occurring on the Refuge is presented in Table 4-5. A partial list of the plant species present on the Refuge is provided in Appendix F.

Table 4-5
Summary of the Habitat Types Occurring on the Seal Beach NWR

Habitat Type	Approximate Acres
Subtidal	
Eelgrass present	95
No eelgrass	166
Intertidal mudflat	52
Intertidal salt marsh	565
Tern nesting island	3
Restored Upland (coastal sage scrub)	5
Disturbed Upland	34
Developed (roads, structures)	45
TOTAL ACREAGE	**965**

4.3.3.1 Shallow Subtidal Habitat

The muted tidal regimes within the Refuge's four tidal basins (i.e., Forrestal Pond, Case Road Pond, 7th Street Pond, and Perimeter Pond) support large areas of continually submerged, shallow subtidal habitat. These ponds were created in the early 1990s as mitigation for the Port of Long Beach's Pier J Landfill project. In total, 116 acres of wetland habitat was restored within the Refuge as a result of this project. Tidal waters from Anaheim Bay enter and exit the restored ponds via constructed channels and culverts that pass under the surrounding roadways. The largest of these culverts are located to the east of the intersection of Kitts Highway and Bolsa Avenue, under the railroad tracks paralleling Forrestal Avenue, and at the southeast corner of the 7th Street Pond. The 14.4-acre Forrestal Pond, which is surrounded on three sides by roads, and the 7.5-acre Perimeter Pond, which is surrounded on all sides by salt marsh habitat, each support predominantly shallow subtidal habitat. The other two ponds, the 52.4-acre Case Road Pond and the 41.3-acre 7th Street Pond, in addition to supporting shallow, subtidal habitat, also include islands mostly comprised of salt marsh habitat. Additional areas of shallow subtidal habitat occur at the southern most ends of the three major tidal arms that extend from the main channel that connects the marsh to the ocean through the inner and outer harbors (refer to Figure 4-13).

Eelgrass (*Zostera marina*), a type of seagrass, occurs in various locations throughout the Refuge's subtidal habitat, including some of the subtidal channels and all of the mitigation ponds (refer to Figure 4 -13). Eelgrass beds provide microhabitats for a wide variety of invertebrates and small fishes, and provide important foraging areas for black brant and other types of waterfowl. The

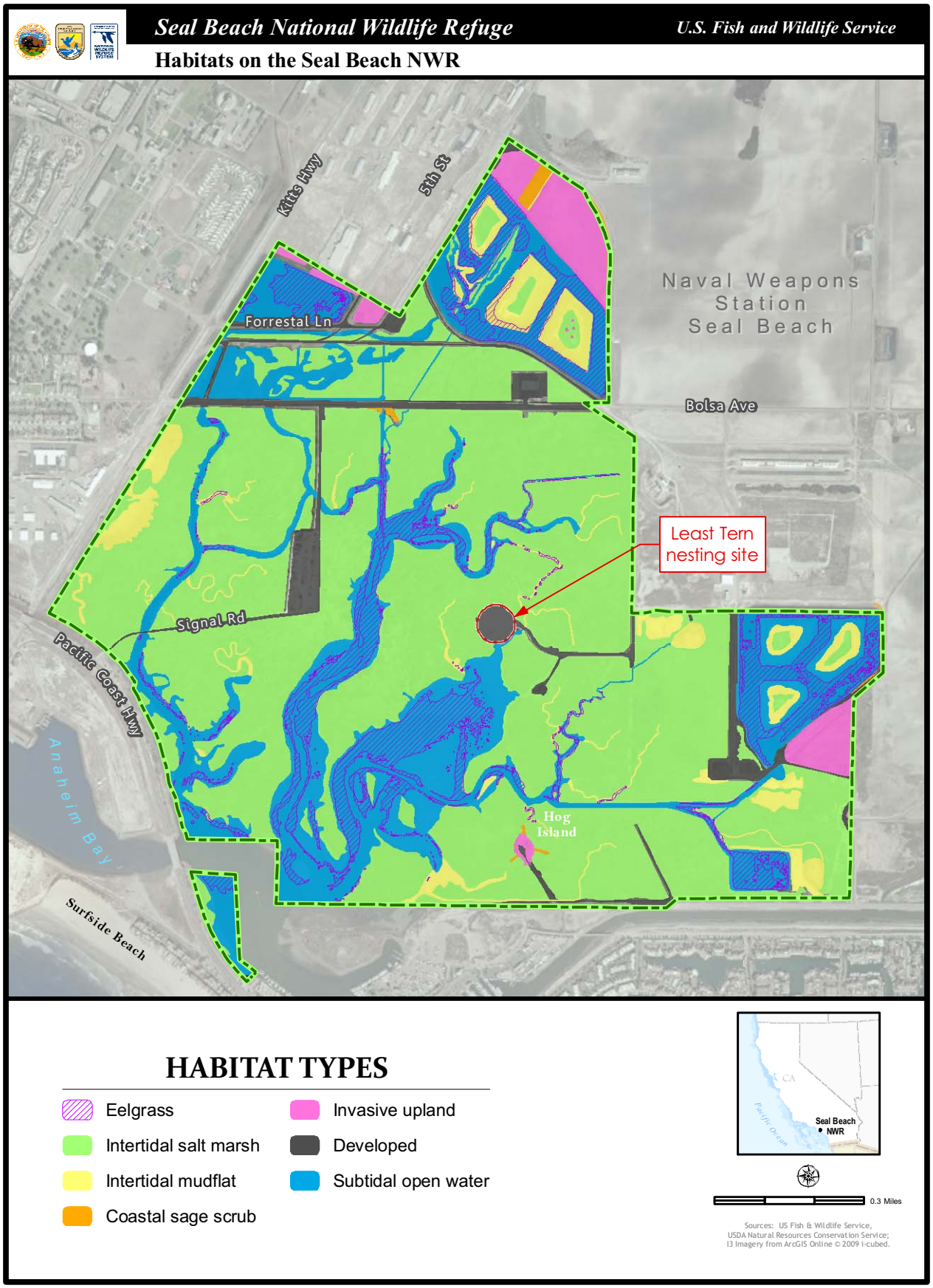

Figure 4-13. Habitat Types on the Seal Beach NWR

roots and rhizomes of the eelgrass help to stabilize the channel bottoms and the eelgrass blades help to cut down wave action, supporting fine sediment deposition.

The unvegetated portions of the shallow subtidal habitat within the Refuge are also important because of the major species assemblage that occurs there. Nematode and polychaete worms, gastropod mollusks, crabs, isopods, and a wide variety of smaller crustaceans transform detritus and smaller invertebrates into usable food for larger invertebrates and fishes (*U.S. Navy 2000*).

4.3.3.2 Intertidal Channels and Tidal Mudflat Habitats

Only the southernmost end of the tidal channel system supports subtidal habitat; the rest of the system is considered intertidal. Intertidal habitat encompasses the area between the high and low tides and is subject to varying degrees of tidal submergence (*U.S. Navy 2011*). A comparison of the pattern of the tidal channels that cut through the marsh plain in Anaheim Bay in 1873 (refer to Figures 4-3 and 4-5) with the channel pattern in 2008 indicates surprisingly little change within the area of the marsh that is now protected within the Refuge. This complex tidal channel network ensures full tidal circulation throughout the natural marsh habitat, transporting oxygen and nutrients and regulating salinity levels. These tidal channels also serve as pathways for fish and other marine organisms to reach the rich foraging areas available within the marsh. Within the tidal channels, the principal vegetation is algae. The dominant species of algae within the Refuge, as recorded during surveys conducted in 1971 and 1972, included *Enteromorpha sp.*, the most abundant genus, and *Ulva lactuca* (*State of California 1975*).

Intertidal flats occur between the lowest cordgrass area and the highest eelgrass beds, approximately 3 to 0 feet Mean Lower Low Water (MLLW). Intertidal flats can consist of various combinations of clay, silt, sand, shell fragments, and organic debris. The water levels on the flats are determined by the daily tidal cycles, which submerge or expose the surface approximately twice per day (*Goals Project 2000*). These mudflats contain abundant organic matter and microorganisms, but not at the level found in eelgrass beds or salt marsh habitat. Although generally thought of as unvegetated, mudflats often contain areas of microorganisms, including diatoms and blue-green algae, which provide food for various species of worms and other invertebrates. Seasonal growth of macroalgae, such as *Enteromorpha* sp., *Cladophora* sp., and sea lettuce (*Ulva* sp.), can also occur. The invertebrates found on these mudflats include organisms that feed on detritus and algae, as well as snails, crabs, and polychaete worms, that glean food from the mud substrate or capture prey in the shallow water.

When the tide enters Anaheim Bay, numerous fishes, sharks, and rays move in to take advantage of the productivity of the mudflats. While most mudflat fish are transient visitors, a short list of mudflat fish species are full-time residents, typically residing in the burrows of marine invertebrates. Still other fishes are seasonal visitors during juvenile life stages. The tidal flats serve as nurseries for the resident juveniles and the sub-adults, which migrate to the subtidal area to avoid low tide conditions on the flats. While relatively constant salinities and temperatures in offshore waters benefit larval development, these larvae eventually drift onto tidal flats so that the juvenile stages of these fish may take advantage of higher temperatures, abundant food, and the absence of large predators. Tidal channels support important nurseries for several species of sport and commercial fish such as California corbina (*Menticirrhus undulatus*) and California halibut (*Paralichthys californicus*).

When the tide ebbs, shorebirds appear on the scene to consume invertebrate prey. Each shorebird species is adapted to a certain zone, as revealed in a spectrum of bill lengths and specialized feeding behaviors that correspond to the different lifestyles and niches of mud-dwelling

invertebrates. Shorebirds are the most conspicuous species depending upon intertidal habitat for feeding, roosting, and resting. The highest densities of nearly all shorebirds are found in intertidal flats and channels; likewise, the majority of large and small wading bird species occur in these habitats.

4.3.3.3 Coastal Salt Marsh Habitat

Coastal salt marsh habitat (classified as estuarine intertidal wetlands) is composed of salt tolerant vegetation and occurs in the upper intertidal zone above the mudflats. It is within the range of regular (daily) to irregular (less than daily) tidal inundation and is exposed more than inundated. Occupying approximately 565 acres, coastal salt marsh habitat is the predominant habitat type within the Refuge.

Although shorebirds use salt marsh to a lesser degree than tidal flats, salt marsh does provide nesting, feeding, and a high-water escape area for many species of birds, including the Federally listed endangered light-footed clapper rail and State endangered Belding's savannah sparrow. In addition, some shorebird species such as the willet, least sandpiper, and long-billed dowitcher use salt marsh habitat for diurnal and nocturnal roost sites perhaps because it provides some protection from predators (*Hickey et al. 2003*). The Refuge's salt marsh habitat also provides food and cover for some 40 species of fish and more than 100 species of marine invertebrates. Nineteen species of vascular plants commonly occur in the salt marsh habitat and of these plants, 12 species comprise the majority of the vegetation.

Coastal salt marsh habitat is most often described in terms of elevational zones (i.e. low, middle, and high marsh); however, some argue that zones based primarily on elevation inaccurately describe the overall plant species composition of the marsh plain, which is influenced by a number of other variables beyond elevation such as salinity, temperature, nutrient levels, sediment characteristics, and past disturbance (*Zedler et al. 1999*). Zedler suggests that the various habitat designations within Southern California salt marsh would be better described as cordgrass (*Spartina foliosa*) habitat, marshplain, and high marsh dominated by glasswort (*Salicornia subterminalis*). Regardless of how they are described, there are three distinctive zones or subtypes within coastal salt marsh habitat.

At lower elevations, salt marsh habitat overlaps with intertidal flats and is subject to regular inundation. The predominant plant in this zone is cordgrass. Other plant species found in this zone include pickleweed (*Salicornia virginica*), saltwort (*Batis maritima*), and annual pickleweed (*S. bigelovii*). Although cordgrass is quite abundant within the Refuge, its pattern of growth is quite different from that of nearby Upper Newport Bay. The density (number of stems) of the cordgrass in the two locations is very similar, however, the height and cover is much greater in Upper Newport Bay (*Massey et al. 1984*). Cordgrass vigor in Anaheim Bay appears to be compromised by several factors including the relative lack of freshwater influence within the marsh (*USFWS 1990*) and land subsidence. Subsidence of the marsh appears to be related to oil extraction that is occurring beneath the bay. Studies conducted between 1957 and 1970 indicated that the marsh elevation dropped a total of 4.9 inches (12.5 centimeters) during the study period (*Massey et al. 1984*). Subsequent studies conducted between 1985 and 1994 indicated a slight rebound in the elevation with increases in elevation of approximately 0.24 inches (0.6 centimeters) to 0.96 inches (2.4 centimeters) throughout the marsh (*U.S. Navy 2011*). This lower elevation combined with short stem height, which is associated with limited freshwater input, results in the complete inundation of the cordgrass stands in Anaheim Bay during all but the lowest of high tides. This prolonged immersion has additional adverse effects on plant vigor as a result of reduced oxygen availability to the roots and reduced sunlight to the stems (*Massey et al. 1984*). The influence that freshwater has on cordgrass vigor was observed in 2005 (*Zembal et al. 2006*)

following a period of significant rainfall in late 2004 and early 2005. The increased height and vigor of the cordgrass was noted on November 15, 2005 when a significant amount of protruding cordgrass cover was visible during an extremely high 6.7-foot tide.

Middle marsh, or marsh plain, is typically characterized by the presence of saltwort and pickleweed. Other species identified in the upper portion of the pickleweed zone include arrow grass (*Triglochin concinna*) and Jaumea (*Jaumea carnosa*) (*Baker in Lane and Hill 1975*). At Anaheim Bay, middle marsh species are found at the outer edge of the marsh, with no clear line of demarcation between these species and cordgrass (*CDFG and USFWS 1976*).

The upper zone of salt marsh habitat lies above the mean high tide line and is flooded only during the highest spring tides. Dominant plants include glasswort and pickleweed, with a variety of other plant species also present including alkali heath, estuary seablite, alkali weed, salt grass, sea lavender, and shore grass. Within those portions of Anaheim Bay that are subject to full tidal flushing, high marsh habitat is limited to narrow strips of land located along the edges of the road fills and old berms. High marsh habitat also occurs in portions of Case Road Pond, around the edges of some of the islands present in 7th Street Pond, and in the Bolsa Cell, located to the north of Bolsa Avenue. The muted tidal regime in this area isolates the salt marsh habitat from full tidal influence, supporting dense stands of pickleweed.

The highest elevations of the high marsh zone are often referred to as wetland/upland transition or upland transition marsh. This habitat zone is not considered a distinct community; rather it represents a gradient between the upper marsh and the native upland habitats of coastal sage scrub and maritime succulent scrub. Unfortunately, no remnants of historical upland transition habitat remain around Anaheim Bay. Some areas adjacent to the marsh habitat do support a few native species, but for the most part, these areas are dominated by non-native weeds and grasses. Other areas have been planted with native upland species in an effort to create a more natural wetland/upland transition zone.

4.3.3.4 Upland Habitat

The Refuge contains about 65 acres of uplands, most of which were historically wetlands that were filled during the last century to support a variety of uses associate primarily with military and agricultural activities. Approximately 41 acres of these uplands have been developed to support roads, berms, railroad tracks, and other structures associated with past or current operations on NWSSB. The remaining undeveloped uplands consist of non-native grasslands, natural and man-made islands, and native shrub revegetation areas.

The only area within the Refuge that historically supported native upland vegetation is Hog Island, located in the southern portion of the Refuge. None of the original native vegetation exists on Hog Island today, and the area referred to as Hog Island is actually larger today than it was in the past. Only about one acre at the center of present day Hog Island is actually part of the original natural upland island. The three "arms" that extend out from the island consist of fill material placed there to support past military uses. These "arms" were recently planted with native vegetation to support uplands birds, as well as to provide cover for shorebirds and other waterbirds during high tides.

Another upland area within the marsh is NASA Island. This 2.9-acre island is man-made and was constructed for rocket testing in the mid 1960s. It was used for this purpose until about 1977, when the site was turned over to the Service for conversion to a nesting site for the California least tern (*USFWS 1985*). To make the site suitable for nesting, the area was leveled and portions of the site

were capped with sand. Over the years, additional improvements have been made to enhance the quality of the site for nesting least terns.

The triangular area located to the southeast of the 7th Street Pond currently supports predominately non-native, weedy vegetation such as fivehorn smotherweed (*Bassia hyssopifolia*), common thistle (*Cirsium vulgare*), Maltese star-thistle (*Centaurea melitensis*), milk thistle (*Silybum marianum*), tumbleweed (*Salsola paulsenii*), and black mustard (*Brassica nigra*), as well as patches of native pickleweed. Another upland island, created in Case Road Pond as part of the Port of Long Beach mitigation project, supports native intertidal vegetation at its lower elevations and predominantly non-native, weedy vegetation on the upper elevations near the center of the small island.

The largest undeveloped upland area within the Refuge, occupying about 21 acres, is located to the north of Case Road Pond. In 1977, a portion of this area was planted with crested wheatgrass, a non-native bunchgrass intended to provide food and cover for wildlife. Since that time, the area has been reinvaded with non-native annual grasses and other weedy species. Additional native shrub plantings have been initiated in this area over the years; the site continues to support a mix of native and non-native species.

4.3.3.5 Sensitive Plants

A number of sensitive plants have been previously recorded on the Refuge including estuary seablite (*Suaeda esteroa*), seaside calandrinia (*Calandrinia maritima*), and southern tarplant (*Hemizonia parryi ssp. australis*). Coulter's goldfields (*Lasthenia glabrata* ssp. *coulteri*) has also been recorded on NWSSB immediately to the east of the Refuge and although not yet documented could also be present on the Refuge in appropriate habitat areas.

4.3.4 Wildlife

The extensive subtidal, intertidal mudflat, and salt marsh habitat on the Refuge supports a diverse array of species. The fish, benthic invertebrates, and other marine organisms supported on the Refuge provide important food sources for migratory birds and various marine organisms, including species important to commercial and recreational fishing interests. Also important to many fish, birds, and marine organisms are the extensive eelgrass beds present in the subtidal channels and large mitigation ponds.

4.3.4.1 Birds

Seal Beach NWR and several nearby coastal wetland areas have collectively been recognized by the National Audubon Society as the Orange Coast Wetlands Important Bird Area (IBA). The areas within the Orange Coast Wetlands (each of which could qualify as a separate IBA) protect some of south California's most extensive wetlands, wetlands that provide essential foraging, resting, and nesting habitat for a variety of coastal-dependent migratory and resident bird species (*California Audubon Society 2008*).

Monthly high and low tide bird counts have been conducted on the Refuge since 1996. As a result of these surveys, approximately 190 bird species have been documented on the Refuge. Of these, approximately 32 species of birds are known to breed on the Refuge and 32 additional species of birds have been recorded on the adjacent NWSSB, which includes open grassland, ocean shoreline, and other habitats not present on the Refuge. A complete species list of the birds observed on the Refuge is included in Appendix F.

A variety of foraging habitats are available for the different guilds of birds observed on the Refuge. Shorebirds feed mostly on invertebrates present within the mudflats and tidal channels, while gulls, terns, cormorants, grebes, egrets, herons, and pelicans forage on a variety of fish species present within the subtidal and intertidal zones of the marsh. Dabbling ducks eat plant material, including eelgrass, and/or invertebrates in shallower waters and diving ducks prey on invertebrates or small fish in deeper waters. Canada geese (*Branta canadensis*), which tend to feed on grasses, seeds, and sprouts in adjacent upland areas, use the marsh as a resting area.

Wintering Birds

The Refuge's bird populations can be divided into several broad categories according to when they are present. The greatest species diversity and overall bird abundance on the Refuge occurs when wintering birds (consisting primarily of shorebirds, waterfowl, and raptors) are present. The Refuge's tidal and intertidal habitats are important foraging and resting areas for these and other birds traveling along the Pacific Flyway. Shorebirds, generally the first to arrive, can be expected in August, with the first ducks generally following in September. Past observations indicated that peak bird abundance is typically observed from November through February. Those birds that choose to stay on the Refuge for the entire winter are generally present until April.

Raptors, which are also included in this group of wintering birds, are most abundant on the Refuge in the fall and winter. Of the fifteen species of raptors that have been documented on the Refuge and surrounding NWSSB lands, six species are present to some extent throughout the year. These species include osprey, northern harrier, Cooper's hawk, red-tailed hawk, American kestrel, and peregrine falcon. Other less common species, such as ferruginous hawk, merlin, and prairie falcon, are seasonal visitors generally observed during the fall and winter months. Some of these species stop for a while to hunt and refuel, while others may spend the entire winter in the area. The marsh provides significant foraging habitat for a variety of raptors including osprey, northern harrier, peregrine falcon, red-tailed hawk, merlin, and kestrel. Other species forage in the open grasslands on NWSSB and may be seen roosting on a power pole or other structure within the Refuge.

Another wintering bird of interest on the Refuge is the Nelson's sharp-tailed sparrow (*Ammodramus nelsoni*). This species, which forages on insects, spiders, snails, and seeds, typically winters along the Atlantic Coast from New York to Florida and along the Gulf Coast from Florida to Texas (*Cornell Lab of Ornithology 2003*). However, the species can also be found wintering in a few areas along the California coast (*Sibley 1996*), including Seal Beach NWR. When present, this species can be found within the shrubby habitat along the northern and eastern edges of Hog Island.

Migrant Birds

Another category of birds supported by the Refuge are migrant birds that use the wetlands as feeding and resting stops on their journeys between breeding and wintering grounds. Migratory birds moving south for the winter generally begin arriving at the Refuge in late summer, and are most abundant in the fall. Spring migration generally occurs from February through May for species heading north. Some of the Refuge's spring migrants include Wilson's phalarope, red-necked phalarope, black tern, white-throated swift, green heron, and common merganser (*CDFG & USFWS 1976*).

Summer Residents

Summer residents, the third category of the birds that utilize the Refuge, are present in much smaller numbers than are wintering birds. Many of the summer residents arrive at the Refuge

with the intent of breeding and raising their young. The most important of these is the Federally endangered California least tern, which nests annually on NASA Island. Other summer residents that have nested on the Refuge include the black skimmer, western kingbird, western bluebird, and hooded oriole. In addition to nesting summer residents, the Refuge also provides late summer habitat for post-breeding species such as California brown pelican and elegant tern. Most post-breeding species stay for only a few weeks before moving on to their winter foraging areas (*CDFG & USFWS 1976*).

Year-Round Residents

Year-round residents of the Refuge include water-dependent birds, as well as birds typically associated with upland areas. Some of these birds breed on the Refuge, while others forage on the Refuge, but breed in nearby areas. Still others are migratory birds represented year-round in the marsh by nonbreeding, summering individuals (e.g., willet, black-bellied plover, long-billed curlew, marbled godwit). Gadwall and mallard are two species of migratory ducks that are represented year-round by those individuals that choose to nest and raise their young on the Refuge. The Federally endangered light-footed clapper rail and State endangered Belding's savannah sparrow are two the Refuge's most important year-round residents. Both spend their entire lives within the coastal salt marsh habitat, with the rail favoring cordgrass-dominated salt marsh areas and the sparrow generally utilizing the pickleweed-dominated salt marsh habitat.

Other species that can be observed year-round and regularly or occasionally nest on the Refuge include great blue heron, red-tailed hawk, American kestrel, killdeer, black-necked stilt, American avocet, northern mockingbird, loggerhead shrike, and song sparrow.

4.3.4.2 Mammals

A comprehensive mammal survey has not been conducted for the Refuge; therefore, information about the mammalian populations on the Refuge must be derived from data obtained during monthly night mammal surveys conducted throughout NWSSB and observations made during general Refuge management activities and monthly bird surveys. Nineteen species of mammals were listed as present or potentially present on NWSSB, including Refuge lands, in 1990. Since then, the red fox ((*Vulpes vulpes regalis or macroura*), a native of North America but not of southern California, is believed to have been extirpated from the site. In addition, no evidence of badger or gray fox activity has been observed in the area for many years, although both species historically occurred on the site. Based on this information and the limited amount of upland habitat located within the Refuge boundary, it is likely that fewer than 17 species of mammals are currently present on the Refuge. This includes two potential bat species, Brazilian free-tailed bat (*Tadarida brasiliensis*) and big brown bat (*Eptesicus fiscus*) (*USFWS and U.S. Navy 1990*), however, no survey data for bats are available to verify the presence or absence of specific bat species. Finally, this figure does not include feral cats, which may be present on the Refuge from time to time.

Some of the species known to be present on the Refuge include: San Diego black-tailed jackrabbit (*Lepus californicus bennettii*), a California Species of Concern, California ground squirrel (*Spermophilus beecheyi*), and coyote (*Canis latrans*). The burrowing habits of the ground squirrel have contributed to erosion problems along the artificial slopes of the Refuge's restored ponds, particularly Forrestal Pond and Case Road Pond. Coyote, which generally prey on smaller mammals such as mice, squirrels, and rabbits, also pose a threat to the light-footed clapper rail and California least tern because of their appetite for chicks and eggs.

Harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californianus*) have also been observed in the Refuge's tidal channels and restored tidal ponds. A complete list of the mammals likely to be found on the Refuge is provided in Appendix F.

4.3.4.3 Reptiles and Amphibians

Reptiles and amphibians are generally not well represented within salt marshes; hence their species richness on the Refuge is low, but ongoing upland habitat restoration continues to increase habitat availability for these species. Four species of reptiles are known to occur within the Refuge's upland habitats: the western fence lizard (*Scheloperus occidentalis*), common side-blotched lizard (*Uta stansburiana*), southern alligator lizard (*Gerrhonotus multicarinatus*) and gopher snake (*Pituophis melanoleucus*). The San Diego horned lizard (*Phrynosoma coronatum blainvillii*), a California Species of Concern, has been observed on NWSSB in the past, but its presence has not been confirmed in recent years. A survey of reptiles and amphibians was conducted on NWSSB in 2007 (*Tierra Data Inc. 2008*), but none of the sample sites were located within the Refuge. A total of seven species of herps (i.e., reptiles and amphibians) were observed on the NWS, and of these, three species were located near the Refuge boundary.

During a study of fish abundance in relation to seasonal water temperatures that was conducted on the Refuge between July 2006 and October 2008, on ten different days, the primary researcher, Katherine Jirik, and other colleagues observed eastern Pacific green sea turtles in the 7th Street Pond, as well as the channel leading to the 7th Street Pond. On 50 percent of these days, groups of two to four individuals were observed (*Jirik and Lowe, in review*).

Table 4-6 provides a list of the reptile and amphibian species that have been observed on or near the Refuge; are expected to occur on or near the Refuge; or have historically occurred on or near the Refuge.

4.3.4.4 Terrestrial Invertebrates

The insects present in the salt marsh and adjacent uplands of the Refuge provide prey for birds, mammals, reptiles, and other invertebrates. They are also essential to the process of cycling nutrients by turning soils, feeding on detritus and other organic material, and adding nitrogen in the form of deposited organic fecal material (*U.S. Navy 2011*). Several studies have been conducted over the years that provide some insight into the diversity and abundance of terrestrial invertebrates present on the Refuge.

In the late 1970s, Assis de Moraes (*1977*) conducted a survey of the insects present within the Refuge's salt marsh habitat. Moraes identified 11 insect orders and 93 families, with an estimated 202 species represented within these taxa (*USFWS and U.S. Navy 1990*). The most abundant insects identified by Moraes in the Refuge's salt marsh habitat were in the taxonomic orders Coleoptera (beetles), Diptera (flies), Lepidoptera (butterflies and moths), Hymenoptera (ants, wasps, and bees), and Homoptera (plant hoppers, aphids, scales, and allies) (*USFWS and CDFG 1976*). Among the Coleopteran families, the carnivorous beetle families Carabidae (predaceous ground beetles) and Staphylinidae (rove beetles) had the largest number of species. Dolichopodidae (long-legged flies) and Ephydridae (shore flies) were the families with the largest number of species.

Tiger Beetles. In 1979, Nagano (*1980*) conducted field work along the southern California coast from the San Luis Obispo/Santa Barbara County line south to the Mexican border to determine the population status of tiger beetles (*Cicindela*) along the coast. Of the seven species that were documented in southern California during this study, three species were located within the mudflat

and salt panne habitats on the Seal Beach NWR. Two of the three species found on the Refuge, including Gabb's tiger beetle and Frost's tiger beetle, have been identified by the state as highly imperiled, (*CDFG 2008*). The third species, mudflat tiger beetle (*Cicindela trifasciata sigmoidea*), currently has no listing status. Additional species were previously documented at Seal Beach, but were not observed during the 1979 study.

Table 4-6
Reptiles and Amphibians Expected to Occur on NWSSB[1]

Scientific Name	Common Name	Conservation Status	Status on the Refuge
Amphibians			
Bufo boreas halophilus	California toad		Yes[3]
Hyla regilla	Pacific tree frog		Yes[4]
Reptiles			
Anniella pulchra pulchra	silvery (California) legless lizard	CSC[2]	Yes[4]
Aspidoscelis hyperythra beldingi	Belding's orange-throated whiptail	CSC[2]	Not observed, but potential for occurrence
Chelonia mydas	eastern Pacific green sea turtle	Federal Endangered	Yes
Elgaria multicarinata	southern alligator lizard		Yes[3]
Phrynosoma coronatum (blainvillii)	coast (San Diego) horned lizard	CSC[2]	Historically occurred here
Pituophis melanoleucus	gopher snake		Yes[3]
Sceloporus occidentalis	western fence lizard		Yes[4]
Uta stansburiana	common side-blotched lizard		Yes[4]

Source: (*Tierra Data, Inc. 2008, Jirik and Lowe in review*)

[1] Includes documented species, species known to have historically occurred here, and species for which suitable habitat exists on the site.

[2] CSC: California Species of Special Concern, California Department of Fish and Game

[3] Observed in proximity to the Refuge during the 2007 survey.

[4] Observed on NWSSB during the 2007 survey, but not in proximity to the Refuge.

The genus *Cicindela* is the only genus of tiger beetles commonly found along the southern California coast (*Nagano 1980*). Adult tiger beetles are highly active terrestrial predators that feed on small arthropods, and are generally found on mud or sand near permanent bodies of water. On the Refuge, they are found on the semi-dry, saline flats within the salt marsh habitat. Shorebirds have been observed preying on tiger beetles within the Refuge.

The grub-like larva of the tiger beetle inhabit vertical burrows in areas were adults are also present. The depth of these burrows varies according to the species, the age of the larva, and the surrounding natural conditions (*Nagano 1980*). Intensive human and animal foot traffic can adversely affect local tiger beetle populations, because larval burrows are easily collapsed and the larvae crushed. The literature also notes potential adverse effects to tiger beetles from insecticides used to control salt marsh mosquitoes (*Dunn in Nagano 1980*); however, the specific insecticide in question is not identified. Although it is unlikely that the current mosquito control occurring on the Refuge could adversely affect existing tiger beetle populations, additional research is needed to determine if this activity could pose a threat to these species.

Wandering Skipper. A butterfly of interest that occurs on the Refuge is the wandering skipper (*Panoquina errans*), identified by the state as a highly imperiled species (*CDFG 2008*). Restricted to the coastal zone, the larval form of this species is always found in association with salt grass. In all, Moraes identified approximately 15 species of butterflies and moths on the Refuge (*USFWS 1976*).

Mosquitoes. Mosquitoes, generally considered a vector requiring some level of control, are also present on the Refuge. A vector is any insect or other arthropod, rodent, or other animal of public health significance capable of causing human discomfort, injury, or capable of harboring or transmitting the causative agents of human disease. The mosquito is the vector of most interest within this Refuge. Twelve mosquito borne viruses are currently known to occur in California. The three forms of most concern in Orange County include western equine encephalitis virus, St. Louis encephalitis virus, and West Nile virus. All are carried by wild birds. Infected birds are then bitten by local mosquitoes that can pass the virus on to humans through future bites.

The Orange County Vector Control District (OCVCD) is responsible for the monitoring and control of vectors, and in particular mosquitoes, in Orange County. OCVCD actively works with NWSSB and Refuge staff to monitor and control mosquito populations on Navy and Refuge lands. About 100 mosquito traps are monitored throughout the county to determine what mosquito species are present and in what numbers. Mosquitoes are also tested to determine what, if any, diseases they may be carrying. OCVCD uses two different types of traps: a carbon dioxide trap and a gravid trap. The carbon dioxide trap is used as an attractant for recently mated females. After females mate, they need to find a blood-source to be able to produce eggs. Carbon dioxide is what all animals exhale when they are breathing so the trap mimics a potential blood-meal to the mosquito. The gravid trap is a foul-smelling trap that egg-laying female mosquitoes are attracted to as a potential place to lay their eggs. Some mosquito surveillance locations in the county also include cowbird traps. These traps are used to catch and take blood samples from live wild birds to determine which, if any, mosquito-borne diseases are present in the wild bird population.

Three mosquito surveillance trap stations are located in proximity to the Seal Beach NWR. These include traps maintained adjacent to the Wintersburg flood control channel at the northwestern corner of the Bolsa Chica marsh complex (17531 Bates Circle, Huntington Beach); at the western end of Adolfo Lopez Drive in Seal Beach, just to the northwest of the Refuge across Seal Beach Boulevard; and near the junction of State Route 22, Interstate 605, and Interstate 405, several miles to the northwest of the Refuge. The first two locations, which are located closest to the Refuge, include cowbird traps, as well as carbon dioxide and gravid traps. Two carbon dioxide traps were also recently installed on or near the Refuge, including one at the Refuge office and one at the drop tower. Another trap was installed just off the Refuge to the north of Case Road.

Based on results provided by OCVCD for all trap stations described above (*Jim Green, pers. comm. November 6, 2008*), the following species of mosquitoes have the potential to be present on the Refuge. Only the black salt marsh mosquito (*Ochlerotatus* [*Aedes*] *taeniorhynchus*), California salt marsh mosquito (*Ochlerotatus* [*Aedes*] *squamiger*), and western encephalitis mosquito (*Culex tarsalis*) have been collected or trapped on the Refuge in recent years.

> *Culex quinquefasciatus*: The majority of Orange County's mosquito abatement services and related control activities are directed at this species. Females are active nearly year-around. Larvae are commonly associated with all types of "urban waters" held in sources ranging from swimming pools to flower pots. This species may serve as both Orange County's primary and secondary vector of St. Louis encephalitis virus and West Nile virus.

Culex tarsalis: This species is considered by most mosquito biologists to be the principal encephalitis vector throughout much of its range in North America. It is Orange County's primary vector of western equine encephalitis and primary/secondary vector of St. Louis encephalitis virus. Adults are active during the spring, winter, and fall. Though more common in rural areas, the species has been found breeding throughout the county in association with most types of clean, standing water sources.

Culex stigmatosoma: This close relative of *Culex tarsalis* breeds in stagnant or polluted waters. Females are present throughout the County from spring to early fall. Although this species seldom bites humans, it is an efficient vector of St. Louis encephalitis virus, and therefore represents an important link in the maintenance of the disease in the area's wildlife populations.

Culex erythrothorax: The species has a distinctive reddish-color and is associated with coastal and inland permanent wetlands. Though females do not disperse far (less than 1/4 mile) from breeding sources to bite, their painful bite is usually followed by a severe local reaction. This species has been found naturally infected with western equine encephalitis virus and St. Louis encephalitis virus, but is considered an incompetent vector of either of these mosquito-borne diseases. Laboratory tests have demonstrated this species to be an efficient vector of West Nile virus.

Anopheles hermsi: This spring, summer, and fall mosquito is found sporadically throughout the County in association with breeding sources containing floating mats of filamentous algae. It is rarely found in salt marsh habitat. Although not a problem in Orange County at this time, this species is known as a competent vector of malaria when the disease is present in an area.

Anopheles franciscanus: This species is rarely found in salt marsh habitat and only occurs in limited numbers in Orange County. When present, it can be active during the spring, summer, and fall. It breeds in water sources supporting abundant algal-growths and floating mats of vegetation. This species seldom bites humans and does not experimentally transmit human malaria in the laboratory.

Culiseta particeps: This species usually breeds during the cooler months of the year in shaded algae-laden pools along foothill streams both inland and near the coast. This species is rarely found in salt marsh habitat.

Ochlerotatus washinoi (formerly *Oc. increpitus*): This species occurs along the coast and sporadically inland where it can be locally annoying to residents following wet winters. Larvae develop in the upland portions of salt marshes and in floodwater sections of coastal and inland streams. An annoying day biter, this species is more of a nuisance than a disease vector.

Culiseta inornata: This large, rust-colored winter mosquito is the most commonly encountered mosquito during the cooler months of the year. Larvae develop in all types of natural and man-made sources. Abundant larval populations occur in association with *Aedes squamiger* in salt marsh habitats. At times, this species, which is known elsewhere to be a vector for a number of mosquito-borne encephalitides viruses, can be locally annoying to coastal residents.

Culiseta incidens: This cool weather species is most often encountered from February through March and is found throughout the county in association with rainwater pools,

artificial containers, and ornamental ponds. It can breed in fresh or brackish water. Although this species is not considered to be a disease vector, it can be a biting nuisance.

Ochlerotatus (Aedes) taeniorhynchus: This summer species, with highly contrasting black and white coloration, is one of the most widespread mosquito species in the U.S. Larvae develop in upper portions of salt marshes within pickleweed that has been flooded by high tides. The species is known to fly long distances (up to 20 miles), and although not considered a vector, it is an aggressive biter, and can be troublesome to residents living near breeding sources.

Ochlerotatus (Aedes) squamiger: This species, the California salt marsh mosquito, is a late winter and early spring species that breeds in coastal wetlands flooded by seasonal rainfall. Larvae usually occur in rainwater or high tide filled depressions in association with pickleweed and salt grass. It is an extremely aggressive day and dusk biter with the capacity to disperse long distances of up to 15 miles (*Maffei in Goals Project 2000*) to obtain a blood meal. Bolsa Chica populations have been found naturally infected with a California group encephalitis (Morro Bay) virus. The potential impact of this virus on residents inhabiting coastal areas is unknown (*OCVCD no date*).

Of the species outlined above, only black salt marsh mosquitoes and California salt marsh mosquitoes are known to breed on the Refuge. No freshwater habitat is present on the Refuge; therefore, other species that may have been found in traps on or near the Refuge would have breed on NWSSB or other properties located in proximity to the Refuge.

The life cycle of mosquitoes varies widely among species. Some female mosquitoes lay single eggs on water surfaces, while others lay batches of 100 or more eggs. Other species, such as the black salt marsh mosquito, lay single eggs on moist soil where later flooding is likely. Eggs deposited on water surfaces usually hatch within a day or so, but eggs laid on soil surfaces do not hatch until flooding occurs, which can be months or even years later.

First instar larvae, which are nearly invisible to the naked eye, hatch from the eggs. Larvae molt three more times growing larger after each molt. The fourth instar larvae molt again to become pupae. Adult mosquitoes emerge from pupae within one to two days, with male mosquitoes always emerging first. The entire life cycle, from egg to adult, can be completed in a week or less depending upon water temperature. Adult mosquitoes mate soon after emergence.

To control mosquitoes in Orange County, OCVCD uses a variety of control methods, including mechanical control, biological control, and chemical control, as well as public education. On the Refuge, the three current forms of control include *Bacillus thuringiensis israelensis* (Bti), *Bacillus sphaericus* (Bs), and Altosid® with the active ingredient methoprene.

Bti, a naturally occurring bacterium, is used to kill mosquitoes and black flies in the larval form. It is sold under the trade name Vectobac. When ingested, Bti interferes with metamorphosis. Bs is also a naturally occurring soil bacterium that when eaten by mosquito and black fly larvae toxins are released into the mosquito's gut, causing the larvae to stop eating and die. Bs is sold under the trade name Vectolex. Both products are only effective when active feeding mosquito larvae are present, neither product is effective on mosquito pupae or adults.

Methoprene is a chemical insect growth regulator that retards the completion of the life cycle of the mosquito by preventing the larva from transforming to the pupa (stage between the larva and adult) and/or the adult from emerging from the pupae. The forms of methoprene approved for use on the Refuge include Altosid® XR Briquets (EPA Registration No. 2724-421) and Altosid®

Pellets WSP (EPA Registration No. 2724-448). Although methoprene is not used very often on the Refuge, when needed, it is generally applied as Altosid® XR Briquets, which provides up to 150 days of control. This product is generally applied to an area prior to inundation by extreme high tides. Methoprene is to be used on the Refuge only as a second line of defense.

The OCVCD recently requested that the Refuge allow the use of three new mosquito control products on the Refuge: Natular™, a larvicide with the active ingredient spinosad; Agnique®, a larvicide and pupacide made from renewable plant oils; and AquaAnvil™, a adulticide with the active ingredients Sumithrin, a synthetic pyrethrin, and piperonyl butoxide.

Natular includes the active ingredient spinosad, a product of bacterial fermentation. Spinosad, classified as a "reduced-risk" compound by the USEPA, triggers continuous involuntary nervous stimulus in mosquito larvae that leads to paralysis and death. This product comes in several formulation types including liquid, granule, and extended release tablet.

Agnique is an invisible monomolecular biodegradable film (MMF) made from renewable plant oils that reduces surface tension on standing water. The presence of the film makes it difficult for mosquito larvae and pupae to attach to the surface of the water and ultimate leads to drowning. This product employs a physical, as opposed to toxic, mode of action to control mosquito and midge larvae and pupae. This product can be applied using a backpack sprayer and is persistent for up to 22 days.

The adulticides AquaAnvil™, a water-based formulation, and Anvil 10 +10 ULV, a mineral oil-based formulation, include the active ingredient sumithrin (a combination of a synthetic phenothrin and piperonyl butoxide [PBO]). Phenothrin is a synthetic pyrethroid made to mimic the insecticidal properties of pyrethrins. It works upon physical contact with an insect or after ingestion as a nerve stimulant that affects the nerve channels of insects and ultimately leads to paralysis (*USEPA 2008*). These products are also formulated with piperonyl butoxide, a synergist, to increase the effectiveness of phenothrin. AquaAnvil and Anvil 10 + 10 ULV can be applied with all ultra-low volume (ULV) spray equipment, including non-thermal ULV portable backpack sprayers and suitable truck-mounted thermal fogging equipment.

4.3.4.5 Marine Invertebrates

Surveys conducted in the 1970s identified at least 116 species of marine invertebrates in the salt marsh area of Anaheim Bay (*Reish et al. 1975*). Of the species identified, polychaetes comprised about 65 percent, crustaceans about 15 percent, and mollusks 13 percent. This and other studies indicate that a diverse array of invertebrates inhabit the estuarine and marsh habitats on the Refuge including polychaete worms, sea stars, sand dollars, crustaceans (especially penaeid and palamonid shrimps, and portunid crabs), bivalves (i.e., clams) and gastropods. These creatures fulfill many purposes within the Bay and the marsh, including scavenging, filter feeding, and detritus feeding.

Survey data collected in the early 1990s at the Port of Long Beach mitigation ponds showed the most abundant subtidal and intertidal species to be worms (polychaetes, oligochaetes, and nematodes) and crustaceans (amphipods, ostracods, and copepods). Polychaetes are a class of annelid worm and are primarily deposit feeders. They live in and on sediments and can reach high densities. At the time of Reish's 1975 survey, at least eight polychaete species occurring in the area were unknown from any other bay or harbor in Southern California. Based on total survey numbers, *Cossura candida* was the most common species in the marsh, comprising almost one-third of all polychaetes in the area.

Mollusk communities in southern California salt marshes are typically dominated by *Cerithidea californica*, *Melampus olivaceous*, and *Assiminea californica*, which are all epifaunal surface feeders (*USFWS and U.S. Navy 1990*). Most mollusks are detritus and filter feeders or grazers, and to a lesser extent, predators. The California hornsnail (*Cerithidia californica)*, which serves as food for species such as crabs and birds, is widespread in the Refuge.

Eighteen species of crustaceans have been documented in Anaheim Bay. In their larval form they are an important food source for birds and fish. Crabs are conspicuous as they forage on mudflats. Amphipods, ostracods and copepods are abundant in subtidal and intertidal areas. Amphipods (*Orchestia traskiana* and *O. californica*) and isopods are found under debris near the upper margins of the marsh and ghost shrimp (*Callianassa californiensis*) live in muddy sediments. Also found on the Refuge is the California brackish water snail (*Tryonia imitator*), a species that has been identified by the State of California as imperiled (*USFWS and U.S. Navy 1990*). This species, which inhabits coastal lagoons, estuaries, and salt marshes, is found only in permanently submerged areas and can tolerate a wide range of salinities and inhabit a variety of sediment types (*Kellogg 1980*).

4.3.4.6 Fishes

The earliest available information regarding fish populations in Anaheim Bay is from a paper published in 1916 by Carl Hubbs, who collected fish in the Bay in 1913. Additional collections were made by Hubbs and the California State Fisheries Laboratory between 1919 and 1928 (*Lane 1975*). No attempts to record the diversity of fish fauna in Anaheim Bay were made again until 1969, when a four year effort to describe the biology of the bay was undertaken by faculty and staff at California State University, Long Beach. Surveys to establish fish diversity in the Bay were conducted between 1969 and 1971. A full account of the fish and other resources in the Bay as a result of undertaking are provided in Fish Bulletin #165, "The Marine Resources of Anaheim Bay" (*CDFG 1975*). Additional data were collected in the 1990s as part of the Port of Long Beach's mitigation and monitoring program.

The surveys conducted in the early 1970s identified 45 fish in the Refuge portion of Anaheim Bay, the most common of which was topsmelt (*Atherinop affinis*). Other common species included the round stingray (*Urobatis halleria*), California killifish (*Fundulus parvipinnis*), and California halibut (*Paralichthys californicus*). California halibut, as well as diamond turbot (*Hypsopsetta guttulata*), another commercially and recreationally important fish, use the bay as juveniles, but move out to the open ocean as they approach maturity. Topsmelt, shiner perch (*Cymatogaster aggregata*), Pacific staghorn sculpin (*Leptocottus armatus*), California killifish (*Fundulus parvipinnis*), Pacific anchovy (*Engraulis moradx*), white seabass (*Atractoscion nobilis*), and California corbina (*Menticirrhus undulatus*) all spawn in the bay (*CDFG and USFWS 1976*). The results of these studies also indicated that total numbers of fish were relatively higher in spring and summer months and species diversity was greatest in winter and spring (*Reish et al. 1975*).

In comparing the results of the collections made in the 1920s with those of the early 1970s, one can find several significant differences between the two collections. It should be noted that the collection made in the 1920s preceded the dredging of the outer harbor and construction of the jetties at the western end of Anaheim Bay, which may account for some of these differences. Several species collected in the 1920s were not collected in the early 1970s including California butterfly ray (*Gymnura marmorata*), Señorita (*Oxyjulis californica*), and California scorpionfish (*Scorpaena guttata*). California butterfly ray was however recently collected on the Refuge during stingray research conducted by Kate Jirick.

There were also a number of fish collected in the early 1970s that were not collected in the 1920s. These included: California corbina, spotted seabass (*Paralabrax maculatofasciatus*), white croaker (*Genyonemus lineatus*), pipe surfperch (*Damalichthys= Rhacochilus vacca*), white surfperch (*Phanerodon furcatus*), giant kelpfish (*Heterostichus rostratus*), and notably, topsmelt, which was abundant in the 1970s study and one of the top ten fish taxa collected in the 1990s.

Also notable is that in the 1970s, many species, including bonefish (*Albula vulpes*) and cheekspot goby (*Ilypnus gilberti*), were found to be uncommon in the Bay and kelp pipefish (*Syngnathus californiensis*) and barred pipefish (*Syngnathus auliscus*) were completely absent. However, collections made in the 1990s as part of the Port of Long Beach's restoration monitoring program found cheekspot goby and barred pipefish to be relatively common on the Refuge.

One of the requirements of the Port of Long Beach's restoration project, which restored approximately 116 acres of subtidal and intertidal habitat on the Refuge, was to conduct a five-year monitoring program to demonstrate that the objectives of the restoration had been met. The Forrestal, Case Road, 7th Street, and Perimeter Ponds were all created as part of this mitigation project to offset impacts to fish habitat. To assess the habitat quality of the restored areas relative to the natural wetlands in Anaheim Bay, data on fish abundance, species richness, and composition in the restored areas were collected between 1990 and 1995. The data obtained from the restored areas were then compared with data collected at an undisturbed reference site in Anaheim Bay. The results of the monitoring indicated that fish abundance in the mitigation area was not significantly different from the reference site; however, significantly more species of fish were collected in the mitigation areas (*MEC 1995*). There were also substantial differences in species composition, which indicated that the mitigation areas provided more habitat for fish than did the reference site. One reason for this may be that the subtidal habitat in the mitigation areas is substantially deeper across the tidal range than at the reference site. By the end of the five-year monitoring program, portions of the ponds had been colonized by eelgrass, which provided quality habitat for pipefish, shiner surfperch, and topsmelt (*MEC 1995*). The mitigation ponds continue to provide important habitat for fish and other marine organisms. Table 4-7 lists the five most commonly collected fish species in the mitigation areas and the reference site during the five-year monitoring program.

Table 4-7
Top Five Fish Taxa Collected in Anaheim Bay From September 1990 to July 1995

Collection Site	Taxa	Common Name
Restoration Areas (Forrestal, Case Road, 7th Street, and Perimeter Ponds)	Gobiidae (unidentifiable juveniles)	Goby (unidentifiable juveniles)
	Clevelandia ios	Arrow goby
	Atherinops affinis	Topsmelt
	Engraulidae (unidentifiable juveniles)	Anchovy (unidentifiable juveniles)
	Engraulis mordax	Northern anchovy
Reference Site (Anaheim Bay south of Bolsa Avenue)	Gobiidae	Goby
	Atherinops affinis	Topsmelt
	Atherinidae (unidentifiable juveniles)	Silverside (unidentifiable juveniles)
	Clevelandia ios	Arrow goby
	Atherinidae (<25 mm)	Silverside (unidentifiable juveniles)

Source: (*MEC 1995*)

The data collected during the 1990s monitoring program confirmed the list of common species developed as a result of the work conducted in the 1970s, and added deepbody anchovy (*Anchoa compressa*) to the list of most commonly captured fish from May to November (*U.S. Navy 2011*). Also common in the Bay were killifish, California grunion (*Leuresthes tenuis*), pipefish (*Syngnathus* spp.), and round stingray. Various fish species, including topsmelt and California killifish, found in the shallow salt marsh channels adjacent to NASA Island provide an important food source for the endangered California least tern, as well as numerous other seabirds, waterfowl, and waterbirds. Although not recorded as a result of any of these studies, tidewater goby (*Eucyclogobius newberryi*), is a Federally listed endangered species that has the potential to occur in Anaheim Bay (*USFWS and U.S. Navy 1990*).

Essential Fish Habitat. The Magnuson-Stevens Act, as amended in 1996, states that "one of the greatest long-term threats to the viability of commercial and recreational fisheries is the continuing loss of marine, estuarine, and other aquatic habitats. Habitat considerations should receive increased attention for the conservation and management of fishery resources of the United States (16 U.S.C. 1801 (A)(9))." The Magnuson-Stevens Act, as amended, requires Fishery Management Councils to amend all of their Fish Management Plans to describe and identify Essential Fish Habitat (EFH) for the fishery based on guidelines established by National Marine Fisheries Service (NMFS) to minimize to the extent practicable adverse effects on such habitat caused by fishing, and to identify other actions to encourage the conservation and enhancement of EFH. In addition, the Act requires Federal agencies undertaking permitting or funding activities that may adversely affect EFH to consult with NMFS prior to implementing such activities.

Essential Fish Habitat is defined by the Magnuson-Stevens Act as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." EFH can include both the water column and the underlying bottom substrate of a particular area. Areas designated as EFH contain habitat that is critical to the long-term health of our nation's fisheries. Various properties within the water column such as temperature, nutrients, or salinity can significantly influence which species are present. If these properties are changed, some species could be displaced. The integrity of the underlying ocean floor or tidal channel can also effect species composition and abundance. Some species may require unvegetated sandy or rocky bottoms, while others require underlying surfaces that are vegetated with seagrasses or kelp. Still others rely on structurally complex coral or oyster reefs. A single species may use many different habitats throughout its life to support breeding, spawning, nursery, feeding, and protection functions. EFH encompasses all of those habitats necessary to ensure healthy fisheries now and in the future (*NOAA Fisheries, Office of Habitat Conservation, Essential Fish Habitat Webpage*).

Some EFH has been further refined to address Habitat Areas of Particular Concern (HAPCs). HAPCs, which are to be identified in specific fish management plans to help provide additional focus for conservation efforts, consist of areas supporting ecological functions that are extremely important or are especially vulnerable to degradation. A specific habitat area may be designated as an HAPC based on the importance of the ecological function provided by the habitat, the extent to which the habitat is sensitive to human-induced environmental degradation, the rarity of the habitat type, and/or the extent to which development activities are, or could be, stressing the habitat. The HAPC designation does not impose additional protection or restrictions upon an area.

Anaheim Bay includes areas identified as EFH for various life stages of fish species managed under the Pacific Groundfish and Coastal Pelagic Species Fishery Management Plans. The Pacific Coast Groundfish Fishery Management Plan (*National Marine Fisheries Service 2005*) manages more than 82 species. Fish such as rockfish, sablefish, flatfish, and Pacific whiting that are often (but not exclusively) found on or near the ocean floor or other structures are managed under this

plan. EFH for groundfish includes all areas from the high tide line (and parts of estuaries) to 3,500 meters in depth. Two of the HAPCs that have been identified for this EFH, estuaries and seagrass, occur within the Refuge. Three of the species managed under this Plan have been recorded from Anaheim Bay either recently or in the past. These include: leopard shark (*Triakis semifasciata*), which use the Refuge wetlands as nursery habitat; California scorpionfish (*Scorpena guttatta*), which was collected in the Bay in the 1920s (*Lane 1975*); and English sole (*Parophrys vetulus*), which was collected in the 1970s (*Klingbeil et al. 1975*).
The Coastal Pelagic Species Fishery Management Plan (*Pacific Fishery Management Council 1998*) includes four finfish, Pacific sardine (*Sardinops sagax*), Pacific (chub or blue) mackerel (*Scomber japonicus*), northern anchovy (*Engraulis mordax*), and jack mackerel (*Trachurus symmetricus*), as well as market squid (*Loligo opalescens*). Coastal pelagic species generally live nearer to the surface than the seafloor and the EFH is based on the temperature range where they are found, and on the geographic area where they occur at any life stage. This range varies widely according to ocean temperatures. This EFH includes all marine and estuary waters from the coasts of California, Oregon, and Washington to the 200-mile limit and above the thermocline where sea surface temperatures range between 10° and 26° centigrade. Refuge habitats support two of the species managed under this plan, northern anchovy and pacific sardine.

4.3.5 Federally Listed Endangered and Threatened Species

The federally-listed endangered and threatened species that utilize the habitats within the Seal Beach NWR are described below. This Refuge includes no Critical Habitat areas.

4.3.5.1 California Least Tern (*Sternula antillarum browni*)

The California least tern is the smallest subspecies of the least tern species, measuring less than ten inches in length and weighing 45 to 55 grams. The total wing length is approximately four inches (110 millimeters) (*Massey 1976*). This subspecies has a short, forked tail, and a long, slightly decurved, tapered bill (*Sibley 2000*). Males and females are both characterized by a black cap, gray wings with black wingtips, white underbody, orange legs, and a black-tipped yellow bill.

The California least tern breeds in the United States only along the immediate coast of California from San Francisco Bay south to the Mexican border. Unfrequented sandy beaches close to estuaries and coastal embayments had historically served as nesting sites for this species, but by the 1960s, suitable nesting areas were severely reduced due primarily to coastal development and intense human recreational use of beaches. As a result, the California least tern's numbers plummeted from uncountable thousands to several hundred by 1970, when the least tern was added to the Federal Endangered Species List as an endangered subspecies.

Since 1970, nesting sites have been recorded from San Francisco Bay to Bahia de San Quintin, Baja California. The nesting range in California has apparently always been widely discontinuous, with the majority of birds nesting in southern California from Santa Barbara County south through San Diego County. The loss of historic undisturbed "natural" breeding sites has forced least terns to adapt to a wide variety of alternatives; however, these alternative sites share several basic ecological requirements. Specifically, alternative sites must be relatively flat, open areas, with a sandy or dried mud substrate; relatively secluded from disturbance and predation; and in proximity to a lagoon or estuary with a dependable food supply (*Longhurst 1969, Craig 1971, Swickard 1971, Massey 1974*).

The California least tern is migratory, usually arriving in its breeding area in April and departing in August for the coast of Central or South America. Least terns are colonial but do not nest in as dense a concentration as many other tern species. The nest is a simple scrape or depression in the

sand, in which one to four eggs are laid, usually two. At Seal Beach NWR, the first eggs are generally laid in the second week of May and the last eggs are laid in late June (*Collins 2007*). Range-wide, only one brood is raised; however, the birds will re-nest if eggs or chicks are lost. Parents continue to feed their young even after they are strong fliers

Observations indicated that California least terns lay their eggs at different times generally based on the age of the birds. The first eggs at a nesting site are generally laid by older birds, with a second round of egg laying by younger birds (2 to 3 years old) generally initiated by June 15 (*Massey and Atwood 1981*). Re-nesting by the older birds may also occur in June for those that lost eggs or young chicks during the initial nesting period. The peak of egg laying at Seal Beach from 2003 to 2007 was the third and fourth weeks of May and the first week of June (*Collins 2007*).

This tern species is an exclusive fish-eater, typically feeding on topsmelt, northern anchovy, gobies, and jacksmelt (*Massey 1974, Atwood and Kelly 1984*). Studies on fish dropped at nesting sites suggest that fish size, rather than species, is the essential requirement of suitable prey for the least tern. Feeding is carried out in the calm waters of narrow estuaries or large bays and for a short distance (i.e., usually within two miles of the beach) in the open ocean. The hovering and plunging habits of this species are conspicuous. Adults that are not feeding young tend to go farther and prey on larger fish. After the eggs have hatched, however, the parents make shorter trips, bringing back smaller fish for their chicks. This need to locate smaller fish appears to result in the increased use of freshwater marsh systems and estuarine areas during the post-breeding dispersal phase, suggesting the importance of such habitats when juveniles are learning to fish.

The California Least Tern Recovery Plan, which was originally approved in 1980 and updated in 1985 (*USFWS 1985a*), outlines the actions that should be implemented to restore the California least tern to a stable, non-endangered status. The plan's primary recovery objective is to restore and subsequently maintain the breeding population of California least terns at a secure level so that delisting can be considered. According to the 1985 recovery plan, the annual breeding population in California must increase to at least 1,200 pairs distributed among secure colonies in at least 20 coastal management areas throughout their breeding range. In addition, each secure coastal management area must have a five-year mean reproductive rate of at least 1.0 young fledged per breeding pair.

According to the results of the five year review for the California least tern prepared by the Service in 2006 (*USFWS 2006*), the reproductive rate for the species in 2005 was 0.23 to 0.36 fledglings per pair, which is considerably lower than the values recommended in the Recovery Plan. Despite this lower reproductive rate, the California least tern population in 2005 was estimated at approximately 7,100 pairs, nearly six times greater than the number identified in the Recovery Plan for downlisting and delisting. The Service in the five year review for the least tern indicated that current population figures suggest that the recovery criterion of no less than one fledgling per pair may not be necessary for recovery of this species as populations increases appear to be occurring despite lower reproductive rates. Preliminary estimates of the number of breeding pairs in California in 2010 range from 6,428 to 6,585 breeding pairs, with an estimated 0.27 to 0.37 fledglings per pair (*Dan Marschalek, CDFG, 11/17/10*).

At Seal Beach NWR, least terns currently nest on a peninsula referred to as NASA Island, a three-acre fill site that was converted from military use to a potential least tern nesting site between 1977 and 1979. Historically, California least terns likely foraged in Anaheim Bay and nested on the adjacent coastal beaches of Seal Beach and Sunset Beach (*Collins 2007*). Intensive human use of these beaches likely caused the birds to seek nesting sites elsewhere along the coast. In 1969, least terns were found nesting on a fill area in Sunset Aquatic Park and utilized the area

between 1969 and 1972; another fill site in Huntington Harbour was also used between 1970 and 1972 (*Collins 2007*). Terns began nesting on NASA Island in 1979 and by 1998, approximately 165 breeding pairs were observed using the site.

The recovery strategies included in the California Least Tern Recovery Plan that are specific to the NASA Island nesting site in Anaheim Bay include:

- Preserve and manage existing nesting colonies, such as the one at NASA Island;
- Develop and implement management plans to construct and manage new nesting sites in protected areas including Anaheim Bay;
- Protect and manage adequate feeding habitat for nesting colonies;
- Monitor the least tern population to determine status, distribution, and progress of management during the breeding season;
- Conduct research to obtain necessary information for tern management (e.g., effects of environmental pollutants, factors affecting choice of roosting, loafing, and feeding areas used during breeding and post-breeding seasons, causes of colony disruption and site abandonment, methods for enhancing nesting sites in existing colonies); and
- Develop and implement a conservation education program.

The NASA Island nesting site has been monitored annually since 1998. Monitoring results for this nesting site are provided in Table 4-8.

Table 4-8
California Least Tern Nesting Results for Seal Beach NWR

Year	Estimated Number of Breeding Pairs	Number of Nests	Estimated Number of Fledglings	Estimated Fledgling per Pair Ratio
1987[1]	69	n/a	97 – 109	1.4 – 1.6
1988[1]	82	n/a	65	0.79
1989[1]	97	97	109	1.1
1993[2]	198	201	*	*
1998[3]	165	165	94 – 104	0.57 – 0.63
2000[4]	107	107	180	1.68
2003[5]	30	30	0	0
2004[5]	206	206	73	0.38
2005[5]	130	145	87	0.66
2006[5]	170	186	78	0.47
2007[6]	165	166	12	0.04
2008[7]	166 - 200	206	44	.22 – .27
2009[8]	168-177	177	80	0.45 - 0.48
2010[9]	260	265	32	0.12

* Data for these two categories were considered substantially over estimated based on the methodology used to determine total fledglings and therefore is not included on the table.

Source: [1](*USFWS 1990*), [2](*Caffrey 1994*), [3] (*Keane 1999*), [4](*Patton 2002*), [5](*Collins 2007*), [6](*Marschalek 2008*), [7](*Marschalek 2009*), [8](Marschalek 2010), [9](per comm. Marschalek 11/17/10)

The number of breeding pairs and the number of fledglings at NASA Island fluctuate in some years as a result of various factors including food supply and predation. In 2003, the area

experienced late rain showers, which resulted in the growth of weedy vegetation on the site. This led to nest abandonment and predation of the remaining eggs (*Collins 2007*). In 2006, an unusually high number of nests and eggs were lost for reasons that could not be positively documented; however, great blue heron tracks were noted in the colony (*Collins 2007*). In 2007, predation by both a great blue heron and a coyote, which greatly reduced the number of fledglings produced that year, were observed and documented (*Collins 2007*). It has not been since 2000 that the fledgling to breeding pair ratio has been above 0.70, which is considered by some to be the ratio needed for a stable population (*Fancher 1992*).

The recovery strategies included in the California Least Tern Recovery Plan that are specific to Anaheim Bay (Seal Beach NWR) include:

- Preserve and manage existing nesting colonies, such as the one at NASA Island;
- Develop and implement management plans to construct and manage new nesting sites in protected areas including Anaheim Bay;
- Protect and manage adequate feeding habitat for nesting colonies;
- Monitor the least tern population to determine status, distribution, and progress of management during the breeding season;
- Conduct research to obtain necessary information for tern management (e.g., effects of environmental pollutants, factors affecting choice of roosting, loafing, and feeding areas used during breeding and post-breeding seasons, causes of colony disruption and site abandonment, methods for enhancing nesting sites in existing colonies); and
- Develop and implement a conservation education program.

The NASA Island nesting site is intensely managed immediately prior to and during the breeding season. These activities are often implemented and/or funded through a partnership with the Navy. Pre-nesting season activities include chemical and/or mechanical treatment or removal of invasive weeds and grasses from the sandy nesting substrate; enhancing nesting substrate with additional sand and/or shell fragments, as necessary; and making any necessary repairs to the electrified chain-link fence that surrounds the site.

During the nesting season, the Refuge Manager and the Friends of Seal Beach NWR recruit and train contractors and volunteers for the "Eyes on the Colony" program. Participants in this program watch the nesting site and when necessary take actions to scare off potential predators, such as crows and ravens. They also report any evidence of mammalian predators or evidence of potential predation to the Refuge Manager. The nest site itself is also monitored weekly to estimate and record breeding pairs; count nests, eggs, and chicks; and estimate the number of chicks that are successfully fledged from the site. At the end of the nesting season, the monitoring results are forwarded to the California Department of Fish and Game for inclusion in annual California least tern breeding survey reports. Monitors also attempt to identify the causes of adult, chick, and egg mortality, which can be due to predation (often recorded as potential, suspected, or documented) or non-predation (e.g., abandonment, flooding, human damage). With this information, it may be possible to modify predator management or site protection to avoid such losses in the future. A predator management program has been approved for the Refuge and is implemented year-round to control coyotes, feral cats and dogs, and other potential predators. Predator management is conducted in accordance with the program developed in 1990 and described in the Final Environmental Impact Statement for the Endangered Species Management and Protection Plan prepared by the Service and NWSSB (*USFWS and U.S. Navy 1990*).

Another activity important to the recovery of this species is public education. The significance of the least tern nesting site on the Refuge and the need to protect nesting colonies in other locations

throughout southern California is presented to the public by the Refuge Manager and volunteers during a variety of Refuge activities, including monthly Refuge tours and special guided birding tours. The Friends of Seal Beach NWR also attend off-refuge events where they provide information about the endangered species protected on the Refuge.

4.3.5.2 Light-footed Clapper Rail *(Rallus longirostris levipes)*

The light-footed clapper rail is a hen-sized marsh bird that is long-legged, long-toed, and approximately 14 inches (36 centimeters) long. It has a slightly down-curved beak and a short, upturned tail. Males and females are identical in plumage. Their cinnamon breast contrasts with the streaked plumage of the grayish brown back and gray and white barred flanks.

The light-footed clapper rail uses southern California coastal salt marshes, lagoons, and their maritime environs. The birds typically nest in the lower littoral zone of coastal salt marshes where dense stands of cordgrass are present. They have also been known to reside and nest in freshwater marshes, although this is not common. They require shallow water and mudflats for foraging, with adjacent higher vegetation for cover during high water (*Massey et al. 1984*).

Very limited evidence exists for inter-marsh movements by light-footed clapper rails. This subspecies is resident in its home marsh except under unusual circumstances. Movement within the marsh is also confined and generally of no greater spread than 1,300 feet (400 meters) (*Zembal 1989*). Minimum home range sizes for nine clapper rails that were radio-harnessed for telemetry at Upper Newport Bay varied from approximately 0.8 to 4.1 acres. The larger areas and daily movements were by first year birds attempting to claim their first breeding territories.

Light-footed clapper rails forage in all parts of the salt marsh, concentrating their efforts in the lower marsh when the tide is out, and moving into the higher marsh as the tide advances. Foraging activity is greatest in the early morning, while vocalizing shows a strong peak just before dark. Activities are also tide-dependent. The rails are omnivorous and opportunistic foragers. They rely mostly on salt marsh invertebrates, such as beetles (*Coleoptera*), garden snails (*Helix* spp.), California hornsnails, salt marsh snails (*Melampus olivaceus*), fiddler and hermit crabs (including *Pachygrapsus crassipes*, *Hemigrapsus oregonensis*, and probably *Uca crenulata*), crayfish, isopods, and decapods. This species may also forage on frog tadpoles (*Hyla* spp.), California killifish, and even California meadow mice (*Microtus californicus*). The rails ingest some vegetable matter, including cordgrass stems and pickleweed tips, but this is uncommon.

The pair bond in light-footed clapper rails endures throughout the season, and often from year to year. Nesting usually begins in March and late nests have usually hatched by August. Females lay approximately four to eight eggs, which hatch in 18-27 days. Both parents care for the young. While one adult is foraging, the other adult broods the chicks. By the age of two days, chicks will accompany adults on foraging trips; however, adults have been observed feeding fully grown chicks of at least six weeks of age within 82 feet (25 meters) of their incubation nest. This incubation nest is a second nest constructed by the rails and is used for brooding the young.

Typically, light-footed clapper rail nests are placed to avoid flooding by tides, yet in dense enough cover to be hidden from predators and support the relatively large nest. Cordgrass provides the preferred nesting habitat for light-footed clapper rails. Massey et al. (*1984*) describes the classical clapper rail nest as follows:

> A nest, built in the low littoral zone in a stand of tall dense cordgrass, constructed primarily of dead cordgrass stems. The platform of the nest is built up from the ground or supported in the cordgrass, the rim level as high as 45 centimeters off the ground. A canopy of live cordgrass

stems is pulled over and entwined above the nest, hiding the nest completely from above. The surrounding tall cordgrass provides cover and also allows the nest to float upwards in place during a high tide. A ramp of dead cordgrass stems leads from the platform down and along the ground.

Light-footed clapper rails inhabit coastal marshes from the Carpinteria Marsh in Santa Barbara County, California, to Bahia de San Quintin, Baja California, Mexico. It is believed that most salt marshes along the coastline at one time supported clapper rails. However, recent census data indicate that less than 50 percent of the coastal wetlands in California are currently occupied. Southern California's largest subpopulation of these rails, located in the Upper Newport Bay, has been successfully reproducing since 1980. In contrast, the second and third largest sub-populations at Tijuana Marsh and Seal Beach NWR are known to have undergone significant and episodic decreases in their numbers.

Destruction of coastal wetlands in southern California has been so extensive that many estuaries where light-footed clapper rails were once abundant have been reduced to remnants. Although salt marsh habitat loss, degradation, and fragmentation are the leading threats to these rails, they are also threatened by disturbance, diseases, contaminants, and predation by coyotes, feral cats, crows, raptors, and other avian predators. The light-footed clapper rail was federally listed as endangered in 1970.

The Light-footed Clapper Rail Recovery Plan, approved in 1985 (*USFWS 1985b*), outlines the actions that if implemented will make possible consideration of reclassification of this subspecies to threatened status. The recovery objective for the light-footed clapper rail is to increase the breeding population in California to at least 800 pairs by preserving, restoring, and/or creating approximately 10,000 acres of adequately protected, suitable managed wetland habitat consisting of at least 50 percent suitable marsh vegetation in at least 20 marsh complexes. Recovery Plan strategies specific to Anaheim Bay (Seal Beach NWR) include:

- Restore tidal action to surrounding uplands;
- Determine causes of elevational differences between Anaheim Bay and Upper Newport Bay, investigate feasibility of corrective actions;
- Develop fringing freshwater marsh and create nest hummocks;
- Enhance *Spartina* vigor;
- Control pollutants/debris;
- Identify and resolve water quality problems;
- Coordinate with vector control personnel;
- Establish and monitor permanent vegetation transects in Anaheim Bay; and
- Obtain information on the biology of the rail and its ecosystem to enhance recovery, including investigating factors limiting rail population size in Anaheim Bay.

The first clapper rail count available for the Refuge was conducted in the early 1970s and resulted in an estimate of 100-200 individual birds within Anaheim Bay (*Wilbur 1974*). Annual counts on the Refuge began in 1979 and call counts conducted throughout the bird's U.S. range were initiated in 1980. The results of spring call counts and high tide counts for the Refuge from 1980 to 2005 are provided in Figure 4-14. In 2007, 32 rails were documented during the fall high tide count, and the spring call count detected eight breeding pair, four single birds, and one advertising male (*Hoffman 2008*). In 2008, 20 rails were documented during the fall high tide count, while the 2008 spring call count identified only one breeding pair (*Hoffman 2009*). In 2009, 50 rails were documented during the fall high tide count, while the 2009 spring call count detected 12 breeding pairs. Breeding pair estimates for the Refuge between 1980 and 2008 are provided in Table 4-9.

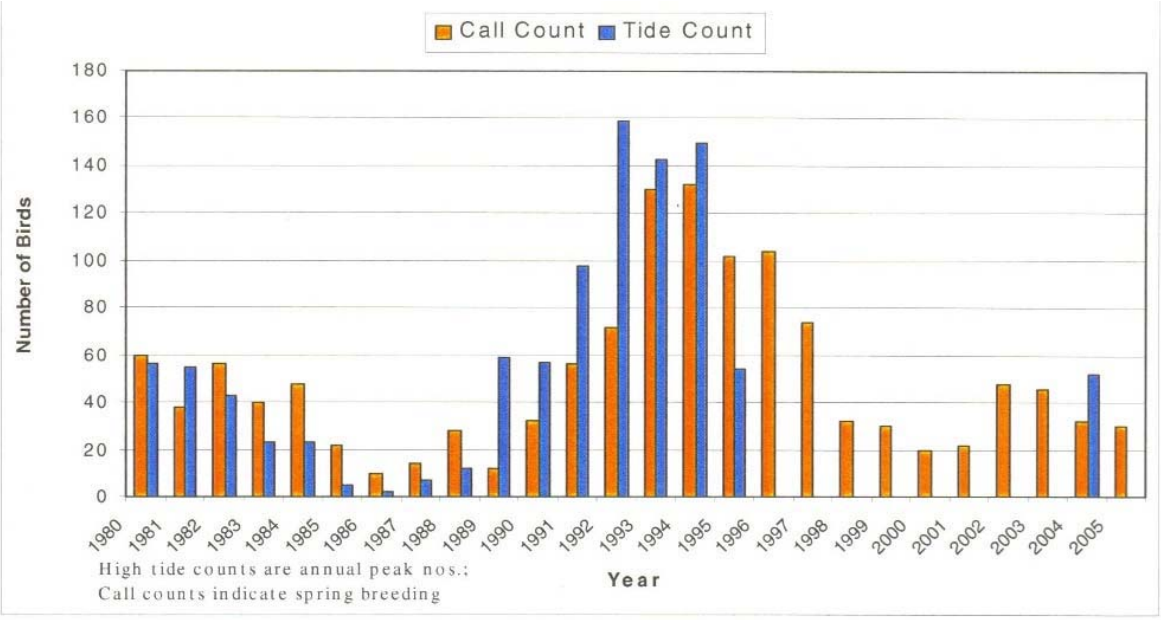

Figure 4-14. Light-footed Clapper Rail Counts on Seal Beach NWR, 1980-2005

Table 4-9
Light-footed Clapper Rail Breeding Pair Estimates for Anaheim Bay (Seal Beach NWR)

Year	Breeding Pairs		Year	Breeding Pairs		Year	Breeding Pairs
1980	30		1990	16		2000	10
1981	19		1991	28		2001	11
1982	28		1992	36		2002	24
1983	20		1993	65		2003	23
1984	24		1994	66		2004	16
1985	11		1995	51		2005	15
1986	5		1996	52		2006	24
1987	7		1997	37		2007	24
1988	7		1998	16		2008	17
1989	6		1999	15		2009	19

Source: 1980 - 2005 (*Zembal et al. 2006*), 2006-2008 (*Hoffman 2009*)

The Refuge's rail population suffered two drastic declines over this period. It was nearly eliminated in the 1980's as a result of non-native red fox predation. In 1984, 24 pairs were documented, but by 1986, only five pairs were observed. The removal of red fox and the provision of floating nesting rafts resulted in a substantial increase in the rail population by 1990. In 1993 and 1994, respectively, 65 and 66 breeding pairs were observed; however, in 2000, the population dropped to just 10 pairs. Avian predation was suspected for this decline.

The number of clapper rails present on the Refuge began to decrease again in 2004, creating concern for the viability of this subpopulation. There are currently no clear reasons for the decline (*Zembal et al. 2006*), although predation is suspected to be at least a contributing factor. A

condition that could be influencing the current trend is the level of the tides relative to the height of the existing vegetation. Tides of 6.5 feet (MLLW) or higher, which occur regularly in the late summer usually in darkness and the fall or winter in the early morning, force the rails to find higher ground on debris or the edge of the marsh where there is little cover (*Zembal et al. 2006*). This exposes the rails to potential avian and mammalian predators.

Current management activities conducted on the Refuge to protect and assist in the recovery of the light-footed clapper rail include pre-season nesting preparation, monitoring during the nesting season, minimizing human disturbance, and implementing predator management. Pre-season nesting preparation involves surveying the current condition of the nesting platforms that have been installed in Anaheim Bay to provide cover and high tide refugia for clapper rail adults, chicks, and eggs. Currently there are approximately 85 of these nesting platforms installed throughout the salt marsh. They are essential to the long term survival of the Refuge's rail population because the probability of a natural nest surviving even moderately high tides in Anaheim Bay's primary salt marsh habitat is extremely low. This is due to the elevation of these high tides relative to the height of the cordgrass. The majority of the marsh is almost completely inundated during moderately high or higher tides. Only one area in the marsh seems to be high enough to avoid complete inundation during these tides. This area is located generally between Hog Island and Perimeter Pond, where active natural clapper rail nests are documented annually. Prior to the nesting season, all nesting platforms in need of repair are removed, refurbished, and replaced or they are discarded and replaced with a new platform. Platforms that based on monitoring do not appear to be used by clapper rails may be removed and relocated, or discarded if they are in disrepair.

Use of nesting platforms on the Refuge began in 1987, when 28 floating rafts were installed in the marsh. Each raft consisted of a wooden platform anchored with two wooden dowels. The dowels were installed in such a way that the platform was anchored but could also float up and down with the tide. To provide cover, dense tumbleweed was secured on top of the platform. Rails began using the platforms for nesting the first year they were installed. Over the past twenty years, the design of the platforms has changed to include a more secure cover over the nesting platform. Other improvements were made to: 1) provide increased stability during strong winds and high tides; 2) eliminate the potential for avian predator perching; 3) increase durability; 4) reduce construction costs; and 5) increase the easy of initial construction and subsequent repairs. Nesting platforms have been installed throughout the marsh, with the greatest number of platforms located between Oil Island and NASA Island and between NASA Island and Hog Island.

Other activities that have been implemented on the Refuge to improve nesting habitat for the rail occurred in 1982 and 1985. In 1982, five nesting hummocks were constructed in the marsh at an elevation above extreme high tide. Over time, natural erosion processes have reduced the height of the hummocks to lower than optimal elevation and they are no longer used for nesting. In 1985, eleven nesting mounds were created in three separate locations by cutting existing berms and old roadways that extended from upland habitat into the marsh. Rail nesting occurred on these mounds for several years, until eggs predation became too common and the rails stopped using the sites for nesting.

Clapper rail monitoring on the Refuge is conducted in partnership with NWSSB and involves monthly monitoring of clapper rail nests, spring clapper rail call counts, and fall high tide call counts. Call count surveys are conducted during the breeding season and throughout the marsh to estimate the ratio of males to females and of paired to unpaired rails. High tide counts are conducted at least once annually in the fall during daytime +6.7 foot or higher tides. During these very high tides, rails are forced to seek higher ground, generally in pickleweed habitat or on

nesting platforms, where they are easily visible to observers. These counts, which provide minimum population estimates, have been conducted since 1975. Annual monitoring reports are prepared to document the data and observations made during the year.

The predator management program approved for the Refuge in 1990 also addresses protection of the light-footed clapper rail from potential mammalian and avian predators. Predator management is implemented year round to control coyotes, feral cats and dogs, and other potential predators. The non-native red fox appears to have been extirpated from the site, however, monthly nighttime predator monitoring is still conducted to determine the types and densities of potential predators on the site and to ensure that no red foxes are present.

To address another issue affecting the light-footed clapper rail population on the Refuge, that of low genetic diversity, translocation of light-footed clapper rail eggs and captive bred birds has occurred on the Refuge on several occasions. Most recently, 13 light-footed clapper rails were released in fall 2008 from the captive rail propagation program occurring in San Diego through a partnership with the San Diego NWR Complex, Chula Vista Nature Center, Sea World of San Diego, San Diego Zoological Society, U.S. Navy, and Clapper Rail Study Team of the Huntington Beach Wetland Conservancy. The translocated birds were banded with a U.S. Fish and Wildlife Service band on the left leg and a blue plastic band on the right leg to denote the 2008 annual code. In August 2009, an additional five light-footed clapper rails were released on the Refuge from the captive breeding program.

4.3.5.3 Western Snowy Plover (*Charadrius alexandrinus nivosus*)

The western snowy plover is a sparrow-sized, white and tan colored shorebird with dark patches on either side of the neck, behind the eyes, and on the forehead (*Page et al. 1995*). The coastal western snowy plover population is defined as those individuals that nest adjacent to or near tidal waters and includes all nesting colonies on the mainland coast, peninsulas, offshore islands, adjacent bays, and estuaries. The breeding range of the western snowy plover extends along coastal beaches from the southern portion of Washington State to southern Baja California, Mexico (*USFWS 1993*).

The breeding season of the western snowy plover extends from March 1 through September 15. Generally, three eggs are laid in a nest, which consists of a shallow depression scraped in sandy or saline substrates. Some nests are lined with plant parts, small pebbles, or shell fragments. Both sexes incubate the eggs for an average of 27 days (*Warriner et al. 1986*). Snowy plovers will re-nest after loss of a clutch or brood. Snowy plover chicks are precocious and leave the nest within hours of hatching in search of food. The tending adult(s) provide danger warnings, thermo-regulation assistance, and guide the chicks to foraging areas, but do not provide food to their chicks. Broods rarely stay in the immediate area of the nest. Young birds are able to fly within approximately 31 days of hatching (*Warriner et al. 1986*). Adults and young forage on invertebrates along intertidal areas, along beaches in wet sand and surf cast kelp, in foredune areas of dry sand above the high tide, on salt pans, and along the edges of salt marshes and salt ponds. The snowy plover is primarily a run and glean type of forager.

Some snowy plovers remain in their coastal breeding areas year-round, while others migrate south or north for the winter (*USFWS 2007*). Flocks of nonbreeding birds, consisting of a mixture of adult and hatching-year birds, begin to form along the Pacific coast in early July. During migration and winter, these flocks range in size from a few individuals to up to 300 birds. In the vicinity of the Refuge, near Huntington Beach and the Bolsa Chica wetlands, the numbers of wintering snowy plovers typically range from 30 to 60 individuals (*USFWS 2007*). A few

individuals are also observed each year at Whiskey 8 Beach on the Naval Weapons Station during the winter count.

Human disturbance, predation, and inclement weather, combined with the loss of nesting habitat to urban development and the encroachment of introduced beachgrass (*Ammophila arenaria*), have led to an overall decline in the breeding and wintering population of the western snowy plover along the Pacific Coast. In southern California, the very large human population and resulting recreation activities have precluded the western snowy plover from breeding on historic beach strand nesting habitat. As a result of these factors, the Pacific Coast population of the western snowy plover was federally-listed as threatened in 1993.

There are only a handful of snowy plover breeding locations currently used in southern California. Well used locations include Bolsa Chica (Orange County), Camp Pendleton, Batiquitos Lagoon, NAB Coronado, Silver Strand State Beach, Naval Radio Receiving Facility, and Tijuana Estuary in San Diego County. No western snowy plover nesting has been documented on the Refuge and although foraging opportunities do exist on the Refuge for the plover, this species is rarely observed on the Refuge. The few observations of this bird that do occur annually on the Refuge are generally limited to the non-breeding season.

4.3.5.4 Salt Marsh Bird's-beak (*Cordylanthus maritimus spp. maritimus*)

Salt marsh bird's-beak is an annual plant that typically grows in the upper elevations of tidal salt marsh habitat, but can also occasionally be found in nontidal salt marsh. Three bird's-beak subspecies grow in the saline marshes of the western United States and Baja California, with the subspecies *Cordylanthus maritimus maritimus* occurring in the coastal marshes of northern Baja California and southern California from San Diego to Santa Barbara Counties.

Salt marsh bird's-beak has an upright, branched growth form with an abundance of purple pigment in its tissues. A hemiparasitic plant, salt marsh bird's beak is believed to derive water and perhaps nutrients through specialized root connections with other species (*USFWS 1985c*). Often found in association with pickleweed, shore grass, salt grass, Frankenia, and sea lavender, salt marsh bird's-beak grows in well-drained/well-aerated soils that dry during the summer and where the only freshwater input is rainfall. Germination occurs in spring when soil salinities are low and soil moisture is high. Studies indicate that freshwater influence in the spring encourages germination and that salinities at the time of germination usually cannot exceed 12 ppt. Flowering usually spans May to October but can sometimes occur during the winter. Pollination by upland, native bees is considered important to seed production, and yearly population numbers depend directly on seed dispersal and a site that provides the precise conditions required for germination.

Colonies of salt marsh bird's-beak are found in only a few scattered salt marsh habitats between Santa Barbara and San Diego Counties. It is currently surviving at Carpinteria Marsh, Mugu Lagoon/Ormand Beach, Upper Newport Bay, Sweetwater Marsh, Naval Radio Receiving Facility (YMCA Surf Camp site), and Tijuana Slough. This species was listed as endangered in 1970 due to destruction and degradation of southern California's coastal salt marsh systems.

The recovery objective for this species is to protect, secure, and manage sufficient salt marsh bird's-beak colonies (20 acres of high marsh habitat at appropriate elevations) in 12 major marshes within the historic range of the plant in the United States (*USFWS 1985c*). The recovery strategies described in the recovery plan for this species that are relevant to the Seal Beach NWR include:

- Reestablish bird's-beak colonies in suitable marshes within its historic range; and
- Develop and implement a public education and awareness program for the preservation of the species and its coastal salt marsh ecosystem.

Herbarium records indicate that salt marsh bird's-beak historically occurred at Anaheim Bay (*USFWS 1985c*); however, it was not present during plant surveys conducted in 1975. The species was reintroduced to three small plots just east of Kitts Highway in early March 1982 using seeds collected from plants occurring in Upper Newport Bay. The seeds sprouted and grew in one of the plots in 1982. Seeds were sown again in 1983 and 1984. A study to monitor the growth and spread of the plants was conducted in 1985 and 1986 (*Massey 1985, Massey 1987*). In 1985, there were 123 plants in one of the plots and one plant in the other. The third plot had no salt marsh bird's-beak plants. This survey indicated that although there were plants, they were not growing in dense clumps, as is characteristic of this species. The plants did not appear to be spreading.

Based on the recommendations of the 1985 study, additional seeds were planted in the same general vicinity in 1986. Seeds sprouted from the 1986 plot and the 1982 plot; however, no spreading of the seeds was evident (*Massey 1985, Massey 1987*). The problem could not be determined conclusively, but seed set was apparently low (*Parsons and Zedler 1997*). After 1986, the number of salt marsh bird's-beak plants declined steadily, and the population is now believed to be extinct on the Refuge.

Despite these initial attempts at reintroduction, the Salt Marsh Bird's-beak Recovery Plan indicates that with the right conditions, Anaheim Bay is an appropriate site for future reintroduction attempts. This is because the site offers secure habitat with minimal potential for disturbance. According to the recovery plan, the factors that should be considered in identifying future reintroduction sites on the Refuge include: ensuring that the proper host and hydrology requirements for maintenance of salt marsh bird's-beak vigor are met and that appropriate native pollinators are present to ensure adequate seed production.

4.3.5.5 East Pacific Green Turtle (*Chelonia mydas*)

The East Pacific green turtle is listed as endangered throughout its range (*National Marine Fisheries Service and USFWS 1998*). This regionally important population of the green turtle has exhibited an extreme decline over the last 30 years. This population decline is attributed to severe overharvest of wintering turtles in the Sea of Cortez between 1950 and 1970, the intense collection of eggs between 1960 and early 1980 on mainland beaches of Mexico, nesting habitat destruction, and incidental capture in commercial fisheries. Primary threats to the species in U.S. waters are from entanglement in debris, boat collisions, fisheries bycatch, and entrainment in coastal power plants.

The East Pacific green turtle is distinguished from the green turtle mainly by size, coloration and carapace shape. The carapace of the adult East Pacific green turtle is narrower, more strongly vaulted and more indented over the rear flippers than that of the green turtle (*National Marine Fisheries Service and USFWS 1998*). The East Pacific green turtle is also conspicuously smaller and lighter than the green turtle. The East Pacific green turtle has a heart-shaped shell, small head, and single-clawed flippers. The adult carapace is smooth, keel-less, and light to dark brown with dark mottling, with whitish to light yellow plastron. Adults feed almost exclusively on sea grasses, including eelgrass, and marine algae.

Although they do not nest as far north as the California coast, Pacific green turtles are often found during the summer months in waters off the coast of California, Oregon, and sometimes as far

north as Alaska (*Southwest Fisheries Science Center 2007*). Stinson (*1984*) reviewed sea turtle sighting records from northern Baja California to Alaska and determined that the East Pacific green turtle was the most commonly observed hard-shelled sea turtle on the U.S. Pacific coast. Most of the sightings (62.0%) were reported from northern Baja California and southern California. The northernmost reported resident population of East Pacific green turtles occurs in San Diego Bay.

On the Seal Beach NWR, East Pacific green turtles have been observed in the 7th Street Pond, as well as the channel that extends from Anaheim Bay into the 7th Street Pond. Between 2006 and 2008, turtles were often observed in groups of two to four individuals.

4.3.6 State Listed Species

Two of the federally listed endangered species supported by Seal Beach NWR, including California least tern and light-footed clapper rail, are also listed as endangered by the State of California. The salt marsh habitat within the Refuge also supports the Belding's savannah sparrow, another species listed by the State of California as endangered.

4.3.6.1 Belding's Savannah Sparrow (*Passerculus sandwichensis beldingi*)

The Belding's savannah sparrow is one of four subspecies of savannah sparrows that are otherwise widely distributed and occur in a variety of habitat types, including grassland, high-elevation meadow, and marshes (*AOU 1983; James and Stadtlander 1991*). The Belding's savannah sparrow is unique in that it represents one of only two wetland-dependant avian species that reside year-round in the coastal salt marshes of southern California (*Powell and Collier 1998*). This salt marsh species is therefore reliant upon coastal salt marsh habitat for its entire life history requirements. This subspecies ranges along the southern California coast from Santa Barbara County (Goleta Slough) in the north to El Rosario, Baja California, Mexico in the south (*James and Stadtlander 1991*).

The Belding's savannah sparrow is a small brown sparrow with fine streaking on the head and face, pale beige to white belly; it often shows a dark central breast spot. As with most ground-dwelling species, this bird is inconspicuous and blends well with its environment. The most distinguishing characteristic is the yellowish color of the lores (area between the bill and eyes) (*Massey 1979*). This subspecies prefers to nest in the mid- to upper-littoral zones of coastal salt marshes (*Collier and Powell 1998*) generally nests within dense stands of pickleweed. The breeding season is generally defined as March 1 to September 1. Breeding territories can be very small and the birds nest semi-colonially or locally concentrated within a larger block of habitat (*Zembal and Hoffman 2002*).

The main factors that influence the long-term survivability of this subspecies are the health and security of its habitat. In southern California, the long-term protection of coastal salt marsh habitat is closely tied to ownership and use of the land. While threats to salt marsh habitat loss or degradation due to the direct impacts of urban development have slowed, the indirect impacts of intensifying development adjacent to areas of coastal salt marsh continue to increase. Human impacts, such as trespassing into closed areas, off-trail use in areas open to the public, and domestic and feral pets entering the marsh, continue to represent a serious threat to the long-term survivability of the Belding's savannah sparrow throughout its range.

This subspecies was listed as endangered by the State of California in 1974 due to a dramatic decrease in the Belding's savannah sparrow population (*Zembal et al. 1988*). This population decrease was attributed to the development, degradation, and fragmentation of coastal salt marsh

habitat. The subspecies has no status under the Federal Endangered Species Act. Since being listed as endangered by the State, many research studies have been completed on this species, including a life history study (*Massey 1979*), studies on habitat requirements (*USFWS 1986, Johnson 1987, Powell 1993*), research on the effects of habitat loss and fragmentation (*Powell and Collier 1998*), and various localized (*Zembal 1986, Kus 1990*) and rangewide surveys (*Bradley 1973, Zembal et al. 1988, James and Stadtlander 1991*).

Because of the secretive nature of this sparrow, it can be difficult to obtain accurate population estimates (*Zembal et al. 1988*). Census techniques consist of searching for territorial males in suitable habitat during the breeding season (late March through early July). Territorial behavior is ascertained through detection or observation of singing, scolding, aerial chases, nest-building, feeding young, or extended perching of individuals or presumed mates perching in an area.

The Belding's savannah sparrow population estimates in California appear to be increasing with 1,084 pairs present in 1973, 2,274 pairs in 1986, 2,350 pairs in 1996, and 3,372 in 2010 (*Zembal and Hoffman 2010*). However, statewide censuses of Belding's savannah sparrows reveal wide fluctuations in local population sizes, with local extirpations occurring in some years.

Belding's savannah sparrows occur year-round on the Refuge, with relatively large numbers of territories documented annually around the marsh edges. Table 4-10 provides survey data for each of the surveys conducted between 1973 and 2010. During the April 2010 survey, 130 pairs of Belding's savannah sparrows were identified in the area of the Refuge located to the north of Bolsa Avenue. Twelve of these pairs were found in the pickleweed habitat occurring around the edges of the three islands in the Case Road Pond. Other areas of concentration included the edges of NASA and Hog Islands and the southeast corner of the Refuge, which was restored in 1980 (*Zembal and Hoffman 2010*). In 2010, the Refuge supported the second largest number of Belding's savannah sparrow territories in California.

Table 4-10
Belding's Savannah Sparrow Territories at Seal Beach NWR

Year	Number of Territories
1973	125
1977	267
1986	244
1991	138
1996	234
2001	293
2006	289
2010	326

Source: (*Zembal and Hoffman 2010*)

4.3.7 Species of Concern and Other Special Status Species

The 1988 amendment to the Fish and Wildlife Conservation Act mandates the Service to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973." The most recent effort to carry out this proactive conservation mandate is the approval of the Service's report, *Birds of Conservation Concern 2008*. The overall goal of the report is to accurately identify bird species at each geographic scale that represent Service conservation priorities and draw attention to species in need of conservation action. The bird species identified are primarily derived from prioritization scores from three major bird conservation plans: The Partners in Flight, U.S. Shorebird Conservation Plan, and North American Waterbird Conservation Plan (*Kushlan et al. 2002*). Birds included in the Birds of Conservation Concern 2008 report are deemed priorities for conservation action. These lists are to be consulted in accordance with Executive Order 13186 "Responsibilities of Federal Agencies to Protect Migratory Birds."

The 2008 report encompasses three distinct geographic scales: the Bird Conservation Regions (BCR) of the United States and Canada, and the cross-border BCRs agreed on with Mexico as part of the North American Bird Conservation Initiative; the USFWS Regions, which each consist of several states in the same geographic area, and the National List, which encompasses the United States, including U.S. island "territories" in the Caribbean and Pacific. Birds of Conservation Concern supported by the Seal Beach NWR are included in the BCR 32 (Coastal California) List, USFWS Region 8 List, and the National List. Table 4-11 lists the Birds of Conservation Concern that have been observed on the Refuge or the adjacent NWSSB.

Table 4-11
Birds of Conservation Concern on and adjacent to the Seal Beach NWR

Common Name	Scientific Name	Foraging Habitat(s)	Abundance on Seal Beach NWR	Included on BCC List		
				BCR 32	Region 8	U.S.[1]
Reddish egret	*Egretta rufescens*	Wetlands	Unusual	No	No	Yes
Bald eagle	*Haliaeetus leucocephalus*	Wetlands	Rare	Yes	Yes	Yes
Swainson's hawk✧	*Buteo swainsoni*	Uplands	n/a	No	No	Yes
Peregrine falcon	*Falco peregrinus*	Uplands, Salt Marsh	Occasional	Yes	Yes	Yes
Mountain Plover✧	*Charadrius montanus*	Grasslands	n/a	Yes	Yes	Yes
Black Oystercatcher	*Haematopus bachmani*	Intertidal	Rare	Yes	Yes	Yes
Lesser Yellowlegs	*Tringa flavipes*	Intertidal	Rare	No	No	Yes
Whimbrel	*Numenius phaeopus hudsonicus*	Intertidal	Seasonally Common	Yes	Yes	Yes
Long-billed curlew	*Numenius americanus*	Intertidal	Seasonally Common	Yes	Yes	Yes
Marbled godwit	*Limosa fedoa fedoa*	Intertidal	Common	Yes	Yes	Yes
Red knot	*Calidris canutus roselaari*	Intertidal	Occasional	Yes	Yes	Yes
Dunlin	*Calidris alpina*	Intertidal	Common	No	No	Yes
Short-billed dowitcher	*Limnodromus griseus*	Intertidal	Occasional	Yes	Yes	Yes
Black skimmer	*Rynchops niger niger*	Open Water, Intertidal	Seasonally Common	Yes	Yes	Yes
Burrowing owl	*Athene cunicularia hypugaea*	Uplands	Occasional	Yes	Yes	No
Short-eared owl	*Asio flammeus*	Uplands	Occasional	No	No	Yes
Costa's hummingbird	*Calypte costae*	Uplands	Unusual	Yes	Yes	Yes
Rufous hummingbird✧	*Selasphorus rufus*	Uplands	n/a	No	No	Yes
Allen's hummingbird	*Selasphorus sasin*	Uplands	Rare	Yes	Yes	Yes
Loggerhead shrike	*Lanius ludovicianus*	Uplands	Rare	Yes	Yes	Yes
Sage thrasher	*Oreoscoptes montanus*	Uplands	Rare	No	Yes	No
Yellow warbler✧	*Dendroica petechia brewsteri*	Uplands	Rare	Yes	Yes	No

Table 4-11 Birds of Conservation Concern on and adjacent to the Seal Beach NWR						
Common Name	**Scientific Name**	**Foraging Habitat(s)**	**Abundance on Seal Beach NWR**	**Included on BCC List**		
				BCR 32	**Region 8**	**U.S.[1]**
Common yellowthroat	*Geothlypis trichas sinuosa*	Uplands	Occasional	Yes	Yes	No
Green-tailed towhee✧	*Pipilo chlorurus*	Uplands	Unusual	No	Yes	No
Nelson's Sharp-tailed Sparrow	*Ammodramus nelsoni*	Uplands	Occasional	No	No	Yes
Tricolored blackbird✧	*Agelaius tricolor*	Wetland	n/a	Yes	Yes	Yes

[1]National List ✧Observed on the adjacent NWS Seal Beach, but not on the Refuge. Source: (*USFWS 2008*)

The California Department of Fish and Game (*2009*) maintains a list a special status mammals, birds, reptiles, amphibians, and fish. The taxa on this list, which are considered to be those of greatest conservation need in California, include species, subspecies, or distinct population of a species native to California that generally fall into one or more of the following criteria:

- Officially listed or proposed for listing under the State and/or Federal Endangered Species Acts;
- State or Federal candidate for possible listing;
- Meet the criteria for listing, even if not currently included on any list;
- California Species of Special Concern, as defined by the Department of Fish and Game;
- Biologically rare, very restricted in distribution, declining throughout their range, or have a critical, vulnerable stage in their life cycle that warrants monitoring;
- Populations in California that may be on the periphery of a taxon's range, but are threatened with extirpation in California;
- Closely associated with a habitat that is declining in California at an alarming rate; and
- Designated as a special status, sensitive, or declining species by other state or federal agencies, or non-governmental organization.

The State also maintains a special plants list entitled "Special Vascular Plants, Bryophytes, and Lichens List" (*California Department of Fish and Game 2010*). "Special Plants" is a broad term used to refer to all the plant taxa inventoried by the Department of Fish and Game's California Natural Diversity Database (CNDDB), regardless of their legal or protection status. Special Plants include vascular plants, high priority bryophytes (mosses, liverworts, and hornworts), and lichens. Special Plant taxa, which can include vascular plants, high priority bryophytes (e.g., mosses, liverworts, and hornworts), and lichens, are species, subspecies, or varieties that fall into one or more of the following categories: 1) officially listed by California or the Federal government as endangered, threatened, or rare; 2) a candidate for state or federal listing as endangered, threatened, or rare; 3) taxa which meet the criteria for listing, even if not currently included on any list, per the California Environmental Quality Act Guidelines; 4) Bureau of Land Management, USFWS, or U.S. Forest Service Sensitive Species; 5) taxa listed in the California Native Plant Society's *Inventory of Rare and Endangered Plants of California*; 6) taxa that are biologically rare, very restricted in distribution, or declining throughout their range but not currently threatened with extirpation; 7) population(s) in California that may be peripheral to the major portion of a taxon's range but are threatened with extirpation in California; and 8) taxa closely associated with a habitat that is declining in California at a significant rate.

Presented in Table 4-12 are plant and animal species, identified as Special Status Species by the State of California, which have been observed on the Refuge in the past or have the potential to occur on the Refuge based on their habitat needs and historic distribution.

Table 4-12
California Special Status Species Observed or with the Potential to Occur on the Seal Beach NWR

Scientific Name	Common Name
INSECTS	
Cicindela gabbii	western tidal-flat tiger beetle
Cicindela senilis frosti	Senile tiger beetle
Panoquina errans	wandering skipper
REPTILES	
Anniella pulchra pulchra	silvery legless lizard
Aspidoscelis hyperythra	orange-throated whiptail
Chelonia mydas	eastern Pacific green sea turtle
Phrynosoma coronatum blainvillii	coast (San Diego) horned lizard
BIRDS	
Agelaius tricolor	tricolored blackbird
Asio flammeus	short-eared owl
Athene cunicularia	burrowing owl
Aythya americana	redhead
Branta bernicla	black brant
Circus cyaneus	northern harrier
Cistothorus palustris clarkae	Clark's marsh wren
Charadrius montanus	mountain plover
Chlidonias niger	black tern
Dendroica petechia	yellow warbler
Lanius ludovicianus	loggerhead shrike
Passerculus sandwichensis rostratus	large-billed savannah sparrow
Pelecanus erythrorynchos	American white pelican
Rynchops niger	black skimmer
Xanthocephalus xanthocephalus	yellow-headed blackbird
PLANTS	
Atriplex coulteri	Coulter's saltbush
Atriplex serenana var. davidsonii	Davidson's saltscale
Calandrinia maritima	seaside calandrinia
Camissonia lewisii	Lewis' evening primrose
Centromadia parryi australis	southern tarplant
Lasthenia glabrata coulteri	Coulter's goldfields
Suaeda esteroa	estuary seablite

The large-billed savannah sparrow (*Passerculus sandwichensis rostratus*), a California Species of Special Concern (*Shuford and Gardali 2008*), also occurs on the Refuge during the winter. This subspecies is typically found in the same areas occupied by the Refuge's Belding's savannah

sparrow populations. During a count conducted on the Refuge in December 2000 a minimum of 47 large-billed savannah sparrows were identified.

4.3.8 Invasive Species

Invasive species are organisms that are introduced into a non-native ecosystem and which cause, or are likely to cause, harm to the environment, economy, or human health. Invasive species can be plants, animals, and other organisms (e.g., microbes) and human actions are the primary means of invasive species introduction. Under favorable conditions, introduced exotic or alien (invasive) species can become established and out-compete a site's native species. In the case of plants, altered hydrologic, soil, and fire regimes are the primary factors contributing to invasive plant germination and establishment. The introduction of other non-native organisms such as birds, insects, or marine organisms can result in problems because there are no natural predators or parasites in the area, which allows the exotic species to multiply and out-compete the native species, often resulting in adverse affects to native species.

4.3.8.1 Invasive Plants

On Seal Beach NWR, the areas most impacted by invasive plants are the uplands, where non-native grasses and annual weeds such as wild oats (*Avena* spp.), bromes (*Bromus* spp.), ryegrasses (*Lolium* spp.), mustard species (*Brassica* spp.), filarees (*Erodium* spp.), fennel (*Foeniculum vulgare*), thistles (*Cirsium* spp.) and wild radish (*Raphanus raphanistrum*) dominate the landscape. Other invasive plants found in these areas and adjacent wetland/upland transition areas include Russian thistle (*Salsola tragus*), fountain grass (*Pennisetum setaceum*), hottentot fig (*Carpobrotus edulis*), Australian saltbush (*Atriplex semibaccata*), perennial pepperweed (*Lepidium densiflorum*) and garland chrysanthemum (*Chrysanthemum coronarium*).

Invasive plants on the Refuge are controlled using a combination of mechanical (i.e., physical removal either by hand, hand tool, or heavier equipment) and chemical (i.e., conventional herbicides applied in accordance with label requirements) methods. Other methods that are available but are not currently proposed include biological (i.e., introduction of a known natural predator or parasite) and controlled burns.

4.3.8.2 Invasive Terrestrial Animals

A number of non-native mammals occur on the Refuge, many of which have minimal if any adverse effects on the area's native species. These include Norway rat (*Rattus norvegicus*), house mouse (*Mus musculus*), and Virginia opossum (*Didelphis virginiana*). The population sizes of these species appear to stay in check in the native habitat areas as a result of coyote and avian predation and limited areas of suitable upland habitat.

One non-native species that invaded the site in the 1970s following a significant reduction in the coyote population on the Refuge and NWSSB was the red fox. This sub-species of red fox, which is believed to be native to the Midwest or the Rocky Mountains, was introduced to the area by people who brought it here for hunting and fur farming. With the coyote no longer present to ward off competitors, the red fox, which is highly adaptable and an adept hunter, quickly established a population on NWSSB. By the mid-1980s, the fox population was having a devastating effect on the light-footed clapper rails and California least terns that nested on the Refuge. The red fox, which is considered a surplus hunter that commonly kills and caches prey in excess of their immediate food needs, was far more devastating to the Refuge's listed species than the coyote. The effects of red fox predation on these listed species prompted the development and implementation of predator management on the Refuge and NWSSB, which is described in detail in the Final Environmental Impact Statement for the Endangered Species Management and

Protection Plan for Naval Weapons Station Seal Beach and Seal Beach National Wildlife Refuge (*USFSW and U.S. Navy 1990*). As a result of this management plan, the non-native red fox is no longer present on NWSSB or the Refuge.

4.3.8.3 Invasive Marine Organisms

The principal pathway for the introduction of invasive marine species into bay environments is via the release of ship ballast water. The release of ballast water could convey benthic species native to other parts of the world into water bodies where no natural predators are present. This could result in serious affects to native marine species. Fish and plankton species can also be transported in ballast water. Other potentially invasive organisms can be transported on the hulls of ships and pleasure boats, or directly released into the water by aquarists or bait fishermen. The common periwinkle (*Littorina littorea*) is a persistent mollusk that impacts intertidal ecosystems. It fundamentally alters the circulation and abundance of algae on rocky shorelines and converts soft sediment to hard substrate. *L. littorea* is native to the northeastern Atlantic. In October 2002, a copious number of *L. littorea* shells were found along the base of a chain-link fence in Anaheim Bay, just north of U.S. Highway 1 within the Refuge. Recreational fishermen frequented this location until a fence was erected in 2003 with the intent of protecting sensitive coastal resources, detering trespassers, and enhancing base security. In June 2004, the largest population of *L. littorea* presently documented on the Pacific Coast of North America was discovered at the southwestern edge of the Refuge along a tidal flat that parallels the east side of parallels Pacific Highway and the west side of the channel connecting Anaheim Bay with Huntington Harbour. No other populations were detected within the bay at that time. Efforts to remove *L. littorea* from the channel were initiated in August 2004. Monitoring for this species was conducted until its presence was no longer detected and was deemed eradicated.

An invasive species which has not been found at Anaheim Bay, but that deserves special attention, is the marine algae known as "killer algae" (*Caulerpa taxifolia*). It was discovered in a coastal lagoon in Carlsbad in June of 2000, and more recently in Huntington Harbour. These introductions into California waters were probably from aquarium water illegally emptied into or near a storm drain, creek, lagoon, bay, or the ocean. *C. taxifolia* spreads mainly by fragmentation and can be transported by boats and fishing gear. Although this species does not pose a human health threat, it does represent a significant threat to the biodiversity of coastal habitats in California. *C. taxifolia* grows extremely rapidly (approximately one inch per day) and can form a dense mat on any surface including rock, sand, or mud. This dense mat chokes out or smothers all native aquatic vegetation in its path when introduced in a non-native marine habitat. Thus, fish, invertebrates, marine mammals, and sea birds that are dependent on native marine vegetation are displaced or die off from the areas where they once thrived. In 1998, *C. taxifolia* was designated a prohibited species under the federal Noxious Weed Act and the importation, sale, transport, and interstate trade of the species is a federal offense.

Other invasive species that have invaded intertidal waters in southern California include Japanese mussel (*Musculista senhousia*), which forms dense mats on substrata that alters sediment properties and may displace native bivalves, and the Australasian isopod *Sphaeroma quoyanum*, which has invaded Sweetwater Marsh in San Diego Bay. *S. quoyanum* burrows into the banks of the marsh's tidal channels and along marsh edge habitat often in very high densities, resulting in increased bank erosion and loss of salt marsh habitat (*Talley et. al. 2001*).

4.4 Cultural Resources

4.4.1 Introduction

All accessible lands (dry land areas) within the Seal Beach NWR have been surveyed for cultural resources, and one site, CA-ORA-298, has been identified within the Refuge boundary. This site was previously evaluated and determined to be eligible for listing in the National Register of Historic Places (NRHP). Four additional cultural sites have been recorded just beyond the Refuge boundary within NWSSB.

Requirements for Federal agencies to identify, evaluate, and protect cultural resources are outlined in several Federal regulations, including the National Historic Preservation Act (NHPA) of 1966, as amended (PL 89-665; 50 STAT 915; 16 USC 470 et seq. 36 CFR 800). The NHPA sets inventory, nomination, protection, and preservation responsibilities for Federally-owned cultural properties and directs Federal agencies to take into account the effects of their actions on items or sites listed or eligible for listing in the NRHP. The criteria used to evaluate eligibility to the NRHP, as contained in 36 CFR 60.4, include, among others, consideration of the quality of the property's significance in American history, architecture, archaeology, and culture and the property's known or likely ability to yield information important in prehistory or history. An historical property must also retain the integrity of its physical identity that existed during the resource's period of significance. Integrity is evaluated with regard to the retention of location, design, setting, materials, workmanship, feeling, and association.

In accordance with the applicable cultural resource regulations, a Cultural Resources Review for Seal Beach NWR (*Zepeda-Herman, C. and J. Underwood 2007*) was prepared to assemble known information about the cultural resources located within and near the Refuge, to identify gaps in the existing data base, and to establish procedures for ensuring compliance with all applicable cultural resource regulations in the context of the CCP process. The findings of this overview are summarized in the sections that follow.

There are currently no federally recognized Tribes in Orange County. However, representatives of the Cahuilla Band of Indians, Juaneno Band of Mission Indians, and Gabrieleno/Tongva Indians of California were contacted as part of the formal scoping process and have been receiving Planning Updates regarding the CCP process for the Seal Beach NWR. No responses have been received to date regarding any traditional uses or the potential existence of sacred sites within the Refuge boundary.

4.4.2 Cultural Setting

While the date that human settlement first began in the coastal area of Orange County is unknown, archaeological evidence indicates people were present in the area at least by the end of the Pleistocene Epoch, over 11,000 years ago. The cultural history for Orange County describes people living during four traditions or horizons: Early Man, Millingstone Horizon, Intermediate, and Late Prehistoric. These periods, which are described below, were first identified by Wallace (1955) and later modified by Warren (1968) and again by Mason and Peterson (1994).

4.4.2.1 Early Man (Initial Occupation – 7,500 B.P.)

The initial occupation of coastal southern California appears to have occurred between 11,000 and 8,500 B.P. (Before Present) (*Jones 1992*). Although little is known about this period in Orange County, the recovery of primarily lithic tools from this period led both Wallace (1955) and Warren (1968) to believe that hunting of terrestrial game was the focus of these highly

mobile early occupants. More recent evidence suggests that these people had a more diverse subsistence focus than previously thought. A possible pre-Millingstone component has been identified at a site near the head of Newport Bay (*Drover et al. 1983*), where significant evidence for shellfish collecting and some evidence for fishing and bird procurement have been documented.

4.4.2.2 Millingstone Period (7,500 – 3,000 B.P.)

Archaeological sites dating to the period following about 8,000 B.P. appear in a variety of settings and are much more common in Orange County than are the earlier sites. They are characterized by abundant groundstone assemblages, including manos and metates. These milling tools permitted the processing of hard seeds and a wide range of plants. Along the coast, shellfish collecting was an important aspect of the diet, and hunting continued to be a source of food.

The relatively extensive deposits and diverse artifact assemblages often seen at Millingstone sites have led some researchers to argue that many of these sites were residential base camps (e.g., *Glassow et al. 1988, Drover et al. 1983*). More recently, Mason and Peterson (1994) have proposed that Millingstone settlement on the Newport Coast consisted of movement among a sequence of reused temporary camps located along resource paths year after year.

4.4.2.3 Intermediate Period (3,000 – 1,000 B.P.)

The period beginning about 3,000 B.P. is characterized by important settlement, subsistence, and technological changes. The introduction of the mortar and pestle suggests the advent of the acorn as a food staple. Fishing technology advanced with shell fishhooks (*Raab et al. 1995*). Projectile points become smaller, implying the use of the bow and arrow (*U.S. Navy 1988*). The use of steatite also begins during this time, indicating trade across the ocean to Catalina Island, the local source for steatite (*Wlodarski et al. 1985*). Many of these innovations seem to signal intensification of subsistence strategies to accommodate a growing population (*Erlandson 1994*). Large camps and habitation sites are first evident during this period, implying a more sedentary and territorial settlement system (*Mason and Peterson 1994*).

4.4.2.4 Late Prehistoric Period (1,000 B.P. – 1800 A.D.)

Between 1,500 and 1,300 B.P. population densities increased significantly, leading to complex social, political, and technological systems (*Wallace 1955*). Economic systems continued to diversify and intensify. Trade networks were well established and the use of shell-bead money began. Inshore and offshore fishing became central to the economic system (*Erlandson 1994*) and reflect an effective fishing technology (*Glassow 1980*). Much of the maritime adaptation was probably influenced by the Chumash. The lifestyle patterns that emerged during this period appear to resemble those of the ethnohistoric Luiseño (including the Juaneño), Gabrieliño, and other Shoshonean speakers.

Several settlement changes in coastal Orange and southern Los Angeles counties occurred at this time: the San Joaquin Hills, abandoned during the Intermediate Period, were reoccupied, while Huntington Beach Mesa and Bolsa Chica Mesa seem to have been abandoned. Some of these settlement shifts may have resulted from the siltation of coastal lagoon habitats and from climate-related disruptions. Most people settled into a relatively limited number of permanent settlements that were located close to a variety of resources. Associated with these primary settlements was an array of hunting and gathering areas that could be utilized seasonally (*Mason and Peterson 1994*).

4.4.2.5 Ethnohistory

Anthropologists (e.g. *Bean and Smith 1978, Kroeber 1925, White 1963*) have generally placed the project area within the traditional territory of the Native American group known as the Gabrieliño. At the time of contact with the Spanish, Gabrieliño territory is thought to have extended from the San Fernando Valley to Aliso Creek, just south of Laguna Beach. Their territory's east-west boundaries extended from Topanga Canyon to present San Bernardino (*Bean and Smith 1978, Kroeber 1925*). To the south were the Luiseño (*White 1963*). The Spanish called them Juaneño, after their mission at San Juan Capistrano. But they had essentially the same language and culture as the Luiseño (*White 1963*). Juaneño descendents, as well as Gabrieliño, have expressed traditional cultural interest in the Seal Beach area.

The Gabrieliño, and the closely related Luiseño, Cahuilla, and Cupeño spoke languages within the Takic family of the Uto-Aztecan stock (*Shipley 1978*). This group is also known as the southern California Shoshonean speakers (e.g., *Kroeber 1925*). The Gabrieliño lived in large primary villages situated near water sources, with secondary hunting and gathering camps occupied seasonally. Their houses were circular, semi-subterranean, domed structures covered with tule or fern. According to Costanso, a diarist with the Portola Expedition of 1769, some were as large as 60 feet in diameter, housing several families (*Teggart 1911*). Subsistence focused on hunting, gathering, and fishing. Groundstone implements, primarily mortars/pestles and manos/metates, were used for grinding both animal and plant foods. Trade was also important, with the distribution of goods focused on shell beads, dried fish, sea otter pelts, steatite, deerskins, and various kinds of seeds (*Reid 1939[1852]*).

4.4.2.6 Historic Period

Spanish settlers arrived in Orange County around 1600 and established large cattle ranches. The mission at San Gabriel was founded in 1771, and the pueblo of Los Angeles was founded ten years later in 1781. Large tracts of land grants were issued to military veterans who established ranchos (*Robinson 1979*). An area of about 300,000 acres, which included the wetlands from Alamitos Bay to Bolsa Chica, was granted by a Spanish concession to an early Spanish settler in 1795 (*U.S. Navy 2011*). The missionaries and Spanish military disrupted the Gabrieliño lifestyle and forced them to provide cheap labor for the ranchos and missions (*Phillips 1980, Reid 1939[1852], Wilson 1952[1852]*). Cattle ranching continued to dominate the economy of Orange County until the late 19th century.

In 1821, Mexico won independence from Spain, and in 1833 the missions were secularized by the Mexican government. Hundreds of land grants were issued to encourage settlement in Alta California (*Phillips 1980, Reid 1939[1852], Wilson 1952[1852]*). An area that included the Alamitos Bay wetlands and part of the Anaheim Bay was encompassed by the 27,142-acre Los Alamitos Rancho established by Manuel Nieto in 1784. Abel Stearns, an American businessman, bought the land in 1842. The American Period began with the end of the Mexican War and the Treaty of Guadalupe Hidalgo in 1848. By 1881 the rancho had been divided into three parts with three owners (*U.S. Army Corps of Engineers 2001*). Sheep and cattle ranching dominated the economy of the area in the late 19th century; however, crop cultivation gradually became more important.

From about 1833 to 1868, Anaheim Bay and its associated wetlands were left relatively undisturbed, although it is likely that some freshwater sources that historically flowed into the wetlands were diverted to provide water for agriculture and human use. By about the 1850s, towns and small farms began to replace large cattle ranches.

German immigrants from San Francisco arrived to grow grapes and produce wine; they bought a portion of the Los Alamitos Rancho in the 1850s and named it Anaheim. To support their agricultural endeavors, water was diverted from the Santa Ana River near the present-day location of Prado Dam (*U.S. Navy 2011*). As this community thrived, the need for a port to ship out the produce emerged. By 1868, the Germans had established the port of Anaheim Landing, west of the Refuge (*Lavender 1987*). Anaheim Landing also became popular as a seaside resort when farmers together with their families brought their produce to ship. The importance of the Landing as a port lessened with the arrival of the Southern Pacific and the Santa Fe railroads, but the resort area continued to grow.

Early development in the area now known as Seal Beach began around the small harbor in Anaheim Bay. By 1903, development plans for the community of Seal Beach (originally known as Bay City) were being implemented by the Bayside Land Company. This development began about the same time (1904) that the Pacific Electric Railway Company commenced operating Red Car Service on the Newport–Balboa Line. This railway, built on landfill, played an important role in the growth of Seal Beach, but by 1940, ridership was so low that passenger service on the line was abandoned.

The 1924 discovery of oil at Seal Beach and then later at Long Beach and Huntington Beach stimulated an economic development boom. Seaside resorts that had begun at Anaheim Landing flourished between Long Beach and Huntington Beach. The City of Seal Beach became a tourist destination, popular for its roller coaster, the longest pier south of San Francisco, bathhouses, gambling halls and ships, saloons and bars, and rum runners.

The Navy acquired the property that is now NWSSB in 1944 and began creation of a harbor and the construction of wharves. After World War II, NWSSB was operated on a reduced workload, but returned to full operation during the Korean War. The Cold War brought aircraft and rocket production facilities into the area (*U.S. Navy 1988*). Between the 1940s and the early 1970s, several areas of NWSSB that are now included in the Refuge were used for a variety of military purposes, including clean fill disposal areas, a landfill operation, explosive burning grounds, primer/salvage yard, and quenching water disposal (*Naval Energy and Environmental Support Activity 1985*).

4.4.3 Existing Cultural Resources Investigations and Research

Numerous cultural resource surveys have been conducted within NWSSB, and the areas previously surveyed within the Refuge are indicated in Figure 4-15. The earliest survey appears to have been carried out in 1980 on 160 acres in the southeast part of the Refuge (*Cottrell and Cooley 1980*). No cultural resources were identified. By 1992, the majority of NWSSB had been surveyed (*Brock 1985*, *U.S. Navy 1988, Stickel 1991, Clevenger and Crawford 1997a*), including all of the areas of dry land within the boundaries of the Refuge.

One of the sites recorded during these surveys, CA-ORA-298, is located within the Refuge boundary. This site, which was first identified as a shell midden with a low density of associated artifacts, was evaluated for listing on the National Register for Historic Places (NRHP) in 1993.

Test excavations associated with this evaluation indicated an area of relatively undisturbed cultural deposit. Recovered artifacts included debitage fragments, a biface, a metate fragment, and a fragment of modified bone. The majority of the biface and debitage fragments were made from chert, with a few made from volcanic material and obsidian. Artifacts were recovered to a depth of 80 centimeters. Radiocarbon analysis yielded a date of 4,530 ± 60 years B.P. (2535 B.C.). This date places the site occupation during the Millingstone Period and is similar to the radiocarbon

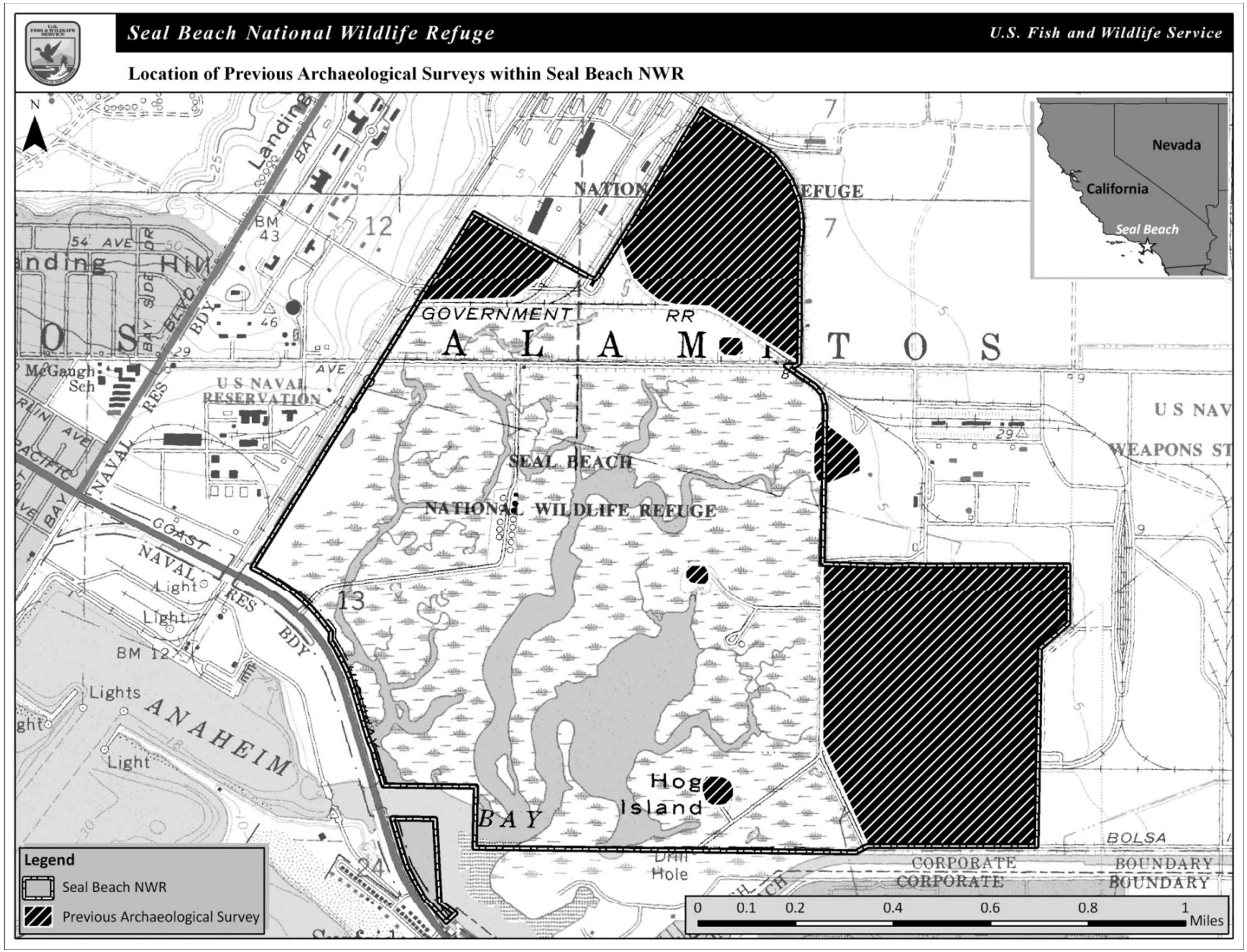

Figure 4-15. Areas of Previous Archaeological Surveys

date for sites located to the west of NWSSB (*Clevenger and Crawford 1997a*). Despite recent disturbance, CA-ORA-298 was determined eligible for listing on the NRHP because the site is likely to yield information regarding coastal adaptation and settlement during the Late Prehistoric Period. Although all of the areas within the Refuge that are accessible have been surveyed for archaeological resources, the Refuge's coastal wetland areas remain unsurveyed due to inaccessibility. The potential for archaeological resources to be present in the existing wetlands is low because these areas were also covered with water during the prehistoric occupation period (*Clevenger and Crawford 1997b*). There is however the potential for yet undiscovered buried deposits to be present within the previous surveyed low elevation dry areas within the Refuge (*Underwood and Cleland 2002*).

A record search of the California Native American Heritage Commission Sacred Land Files was conducted in 1993 by Ogden Environmental in association with the Historic and Archaeological Resources Protection Plan (HARP) completed for the NWSSB. No sacred lands were identified.

Two studies of historic buildings and structures at NWSSB were completed in 1995 and 1999. The first study focused on building and structures of the World War II era (those built prior to 1946) and the second study focused on Cold War era properties. Neither study identified any buildings on the Refuge that were considered eligible for listing on the NRHP. The Refuge contains foundations from previously demolished buildings, magazines, a drop tower (Building 436), Oil Island buildings, and several buildings (Buildings 73, 76, 83, and 88) not in use by the Refuge. Although the Service has the primary responsibility for management within the Refuge, the latter buildings and the Oil Island buildings are the responsibility of the Navy and/or a private entity. The Refuge Office (Building 226) is located outside the Refuge boundary, but within NWSSB. Building 436, the drop tower, was built in 1964 and was determined not eligible for listing on the NRHP under the Cold War era context (*JRP Historical Consulting Services 1999*).

4.5 Social and Economic Environment

Elements of the social and economic environment include land use, public safety, traffic circulation, public utilities/easements; public access and recreational opportunities, vectors and odors, economics/employment; and environmental justice. Although there are a few recreational opportunities provided on NWSSB that occur in proximity to the Refuge, including the Bunker 33 Recreation Center and adjacent recreational vehicle park, these facilities are open only to active and retired Navy personnel and their families. Activities occurring on the Refuge have no potential to affect the operation of these facilities or any of the public recreational facilities that occur to the south and southeast of the Refuge (refer to Section 4.5.1); therefore, no further analysis is needed with respect to this issue.

4.5.1 Land Use

The Seal Beach NWR is situated entirely within the boundaries of NWSSB, which is located in City of Seal Beach, Orange County, California. All of the area within the Refuge is owned by the U.S. Navy with the exception of approximately 58 acres (see Figure 4-7) that are held in trust for the citizens of California by the State Lands Commission and leased to the Service for management as part of the National Wildlife Refuge System. The Refuge is also included within the California Coastal Zone Boundary.

4.5.1.1 Current Uses on the Refuge

The Seal Beach NWR is managed in accordance with the National Wildlife Refuge System Administration Act of 1966, as amended and pursuant to the General Plan approved by the Commander Officer at NWSSB and the Regional Director of the Service in May 1974.

Management actions are directed primarily at preserving and managing the habitat to support the light-footed clapper rail and the California least tern, as well as preserving habitat used by migrant waterfowl, shorebirds, and other water birds.

Wildlife and habitat management actions on the Refuge include controlling invasive plant species through mechanical and chemical methods, planting native shrubs and grasses, constructing and installing nesting platforms in the marsh for light-footed clapper rails, preparing the California least tern site, species monitoring, and culvert repair and replacement. Ongoing wildlife and habitat management actions, some of which are funded in whole or in part by the U.S. Navy, may be divided into four main areas: management for California least terns at NASA Island, management of light-footed clapper rails, general habitat management, and general wildlife management. The primary activities for each of these areas include:

Management for California Least Terns at NASA Island

- Pre-nesting season site preparation, as needed (weed control, substrate enhancement)
- Eyes on the Colony (predator monitoring program supervised by the Refuge)
- Weekly nest site monitoring during the nesting season
- Predator management
-

Management of Light-footed Clapper Rails

- High tide counts and spring call counts (to obtain breeding population size estimates)
- Monitoring during nesting season
- Maintenance, construction, and deployment of nesting platforms
- Predator management

Habitat Management

- Invasive plant species removal
- Native plant restoration
- Trash and debris removal
- Culvert maintenance, as needed to maintain tidal flow

Wildlife Management

- Monthly night mammals surveys
- Monthly high tide and low tide bird counts

Public Use

- Pedestrian pathway along the south side of Bolsa Avenue
- Interpretive signs along the pathway
- Native plant garden adjacent to the Refuge office
- Scientific research when it benefits Refuge management and/or Refuge resources

The Refuge Headquarters occupies approximately five acres of Navy land situated just off the Refuge near the southwest corner Kitts Highway and Bolsa Avenue. The site includes a Navy building that is used for Refuge offices and tour group presentations. Several storage facilities necessary to support refuge operations are located to the southwest of the Refuge office.

Public access to the Refuge is restricted, because of NWSSB's military mission of storing and handling ordnance. To enter the Refuge, non-military visitors must have a military escort, possess a pass indicating a valid purpose for being on the station, or sign up prior to a Refuge event. Participants in the Refuge's public events must be escorted by Refuge or Navy personnel. The

ability for the public to gain access onto NWSSB is always subject to change due to ongoing security concerns. Currently, a three-hour public walking tour of the Refuge is offered once a month. These tours, led by the Friends of the Seal Beach NWR and Refuge staff, are conducted in cooperation with the Navy. Occasional birding tours are also conducted on the Refuge throughout the year and an off-site environmental education program is conducted by the Friends.

Since 2005, the total number of visitors has averaged about 1,000 people per year, as shown in Table 4-13. About 15 percent of these visits are from non-residents and 85 percent are from Orange or Los Angeles County communities (*K. Gilligan pers. com. December 2008*). These visits involve primarily wildlife observation; an estimated 350 visits also involve some interpretation. The average visit length is about four hours.

Table 4-13
Annual Visitation to Seal Beach NWR

Year	Number of Visitors
2005	1,100
2006	1,030
2007	1,030
2008	1,050

Two special events are held on the Refuge each year and attract larger groups of visitors: National Public Lands Day, held on the last Saturday in September, and Tern Island Clean-up and Site Preparation, scheduled in early spring. The numbers of visitors from these two annual events combined is shown in Table 4-14.

Table 4-14
Refuge Visits Associated with Special Events

Year	Number of Visitors
2005	1,000
2006	400
2007	432
2008	250

Facilities that are currently available to accommodate public use on the Refuge include a six to eight-foot-wide pedestrian pathway, consisting of decomposed granite, that leads from the Refuge office east along Bolsa Avenue to an existing observation deck, located about a quarter of a mile east of the intersection of Bolsa Avenue and Kitts Highway. The observation deck is located on the south side of Bolsa Avenue and provides views into the marsh. Interpretive signage on the deck provides the public with information about the habitats and species protected on the Refuge. Also available to the public during organized tours are trails that meander through the native plant garden. Signs have been placed throughout the garden to identify the various native plants and the wildlife in the area.

4.5.1.2 Surrounding Land Uses

Uses on NWSSB. The Refuge is surrounded by the NWSSB, which has largely been developed into support facilities for the Station, including magazines for ordnance storage, office buildings, roads, railroad revetments, parking lots, housing, recreation facilities, and open space. Basic

infrastructure includes 220 buildings, 49 miles of railroad track, 68 miles of paved road, and 127 ammunition magazines.

In addition to the developed areas at the station, more than 2,000 acres of open land on the Station are leased for agriculture use through a leasing program managed by the Navy (*U.S. Navy 2011*). Some fields are dry farmed, while others are irrigated using primarily water from Station wells. Primary crops include barley, lima beans, garbanzo beans, nopales (cactus), cucumbers, cauliflower, green beans, celery, lettuce, squash, peppers, watermelon, strawberries, and cabbage. Approximately two acres of the land set aside for agriculture can be used for apiary (beekeeping) purposes in conjunction with bean production.

A small weapons shooting range, used by military and other government agency personnel, as well as private shooting clubs, is located immediately adjacent to the Refuge, near the corner of Bolsa Avenue and Case Road. As a result of this activity, a portion of the Refuge located near NASA Island is closed to use when the range is operating. This proximity of the range to the Refuge has had an impact on the Refuge's ability to fully implement the Eyes on the Colony Program, because participants in the program are not permitted to use the portion of the access road closest to NASA Island. This situation makes it difficult for participants to get close to the nesting colony and reduces the effectiveness of the monitoring activities. The Refuge is continuing coordination efforts with the Navy in an effort to resolve this issue.

Another use occurring within NWSSB, but outside the Refuge boundary, is oil production. When the federal government condemned the land occupied by the NWS in the 1940s, the former owner, Alamitos Land Company, retained the mineral rights. In 1954, the first oil well was drilled into Anaheim Bay by Hancock Oil Company from the 6.5-acre "oil island" that the company built in the wetlands (refer to Figure 4-1). Roads, which are now maintained by the current holder of the mineral rights (BreitBurn Energy Corporation), were also constructed in the marsh to connect the island to Pacific Coast Highway and Bolsa Avenue. In total, the current mineral rights apply to approximately 112 acres, a portion of which are located below the wetlands included within the Refuge. In accordance with the current agreement between the oil operator and the Navy (Agreement NOY(R)-48519), when the resources within the oil field have been depleted, the oil operator will restore the site, including Oil Island and the associated roadways, to coastal salt marsh habitat (*USFWS and U.S. Navy 1990*). The operator has approached the Navy regarding an amendment to the agreement that would allow the island to remain in the marsh where it could be used to accommodate future visitor activities (*CDFG and USFWS 1976*).

Uses Beyond NWSSB. The properties immediately surrounding NWSSB consist of a mix of industrial and commercial uses and low to medium-density residential development (Figure 4-16). Oil extraction sites are scattered throughout the area. Immediately to the south of the Refuge and to the northwest of the Bolsa Chica flood control channel are recreational uses, including Sunset Marina Park and Sunset Marina Harbour. Although these uses are located within the city limits of Seal Beach, most of the property is owned in fee title by the County of Orange. A portion of the southeast corner of the site is held in the public trust as state tidelands, which are leased to the County of Orange. The developed portion of this property, which is leased to a private operator by the County, is situated on approximately 76 acres and supports primarily boating related activities.

Facilities include a marina with approximately 245 boat slips, a public boat launch ramp, and a marine repair yard. The site also includes an Orange County Sheriff's Harbor Patrol facility; Sunset Marina Park, a small passive public park; approximately seven acres of parking to accommodate 273 boat trailers and vehicle spaces; and a six-acre dry stand board storage facility

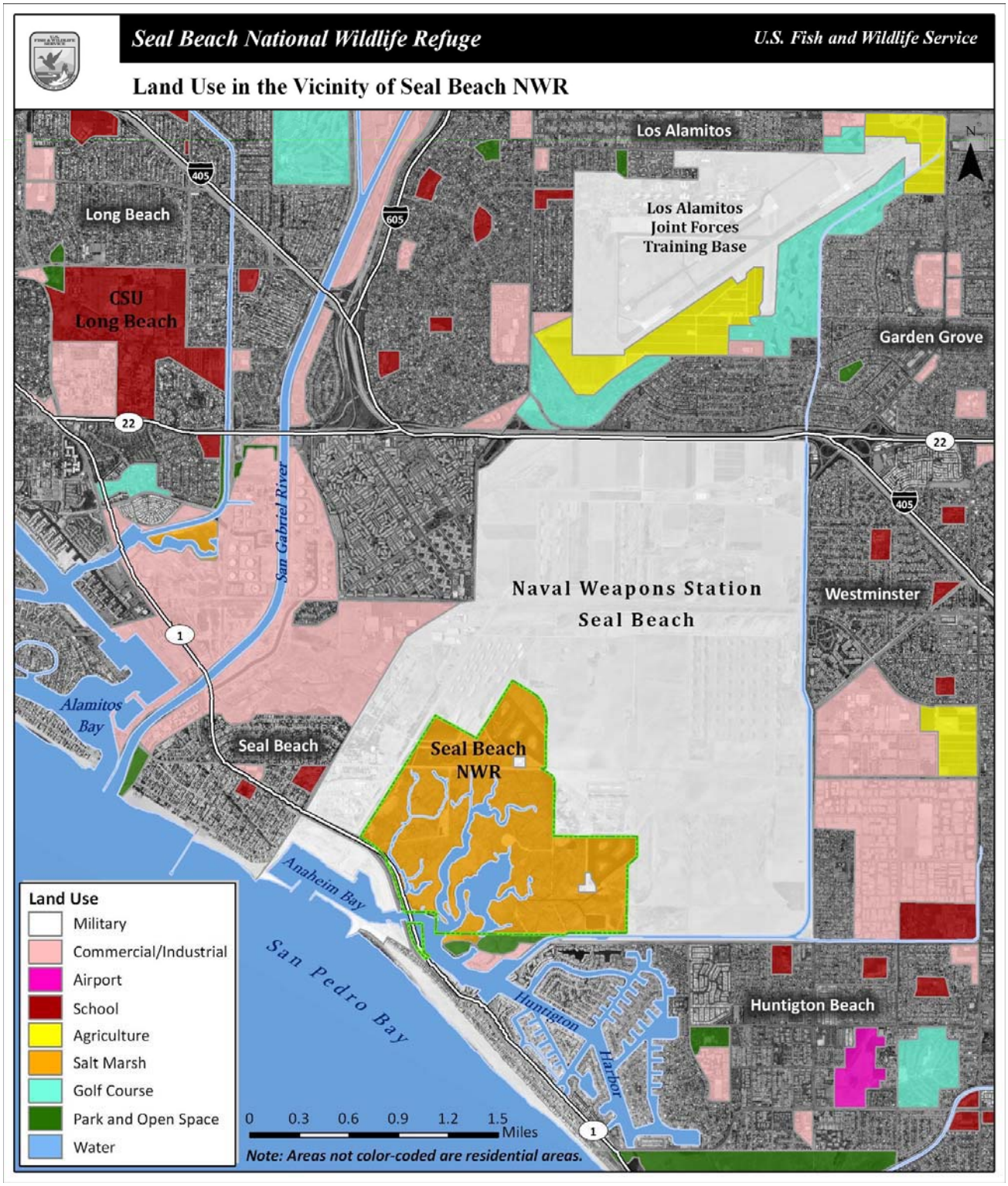

Figure 4-16. Land Use in the Vicinity of Seal Beach NWR

that provides storage for 314 boats. A 100-foot buffer is provided between the developed areas and the adjacent wetlands. To the west of the marina is a 5.5-acre least tern nesting site maintained by the County of Orange. Access to the area is via an existing earthen causeway.

A portion of the City of Huntington Beach abuts the Refuge at the City's northwestern-most corner, where commercial office development, including the Simple Green building, is located. Further to the east in Huntington Harbour the primary land use is residential.

In general, the areas surrounding NWSSB are highly urbanized areas with about 18 million people living within about a two-hour drive of the Refuge. NWSSB is bordered on the northwest by the City of Long Beach in Los Angeles County and the City of Seal Beach in Orange County. To the north is the City of Los Alamitos, to northeast the City of Garden Grove, to the east the City of Westminster, and to the south the City of Huntington Beach. To the southwest is the Pacific Ocean. The 300-acre Bolsa Chica Ecological Reserve, managed by CDFG, is located about two miles to the southeast, on the other side of Huntington Harbour.

The objectives and policies for the Refuge and associated marshlands as presented in the Seal Beach General Plan (*City of Seal Beach 2003*) include:

- Work and cooperate with federal interests to ensure preservation of this area's natural assets. Preserving the marshlands and wetlands in a pristine state is considered to be a matter of significance;
- Develop constructed wetlands on Navy property to improve wastewater runoff quality as it drains to Anaheim Bay; and
- Improve open space habitat on non-essential Navy acreage as buffer zones adjacent to the Wildlife Refuge.

4.5.2 Public Safety

The military mission at NWSSB is to support the Pacific Fleet's combat readiness and sustainability, including safely storing and maintaining ordnance. For this reason, all refuge related activities are generally restricted to lands within the approved Refuge boundary.

A small weapons shooting range operates on NWSSB to the southeast of the intersection of Bolsa Avenue and Case Road. To ensure that no injuries occur in the vicinity of the facility as a result of a stray bullet, a buffer area – the Explosive Safety Quantity Distance (ESQD) - extends southwest from the facility onto the Refuge to just southeast of NASA Island. No activity is permitted within this area when the shooting range is "hot" (i.e., firearms are being fired). Red flags are used to designate a "hot" range.

As a result of historic military operations on NWSSB, there is a potential for buried and unburied unexploded ordnance on the Refuge. To protect the safety of those working on the Refuge, all Refuge staff and volunteers are trained in how to deal with unexploded ordnance if it is encountered.

4.5.3 Traffic Circulation

Access to the Refuge is available via a system of local streets and regional transportation corridors as shown in Figure 1-1 and 1-2. The closest regional transportation corridors include Interstate 405 and Pacific Coast Highway. The segment of Interstate 405 from State Highway 22 to State Highway 55 has been identified as one of the highest congestion areas in the Los Angeles/Orange County area. Traffic volumes on the segment of Pacific Coast Highway that extends through the

City of Seal Beach exceed the design capacity of the road (*City of Seal Beach 2003*), resulting in congestion during peak hours, as well as during some non-peak hours. The Seal Beach General Plan indicates that as a primary highway (4 lanes divided), there is insufficient capacity on Pacific Coast Highway to accommodate existing, as well as future traffic volumes.

From these regional corridors, visitors would likely use Seal Beach Boulevard or Westminster Avenue to get to approved parking areas on NWSSB. Both Seal Beach Boulevard and Westminster Avenue in the vicinity of the Refuge, currently experience traffic volumes below existing design capacity and therefore operate within acceptable Levels of Service even during peak travel periods.

One of two entrances is available for controlled public access onto the Refuge at any one time. The first, located at the intersection of Seal Beach Boulevard and Forrestal Avenue, includes a parking lot that is located outside the entry gate to NWSSB. The second, located off Westminster Avenue at Kitts Highway, has controlled parking available inside the entry gate. Both entrances are accessed via signalized intersections.

4.5.4 Public Utilities/Easements

A number of public utilities, including electrical lines, sewer lines, and storm drain facilities, are located within the Refuge boundary. Electrical power lines, maintained by Southern California Edison, consist primarily of 12 kilovolt electrical power lines and associated utility poles that extend east/west along the south side of Bolsa Avenue, and on the north side of Bolsa Avenue to the east of the Bolsa Cell. An underground power line with associated manholes also extends from the north into the Bolsa Cell, just to the east of Forrestal Pond. The northern boundary of the disturbed upland area to the north of Case Road Pond supports an electrical power line and telephone communications line. A sewer line also cuts across the northwest corner of this disturbed upland area. A water line extends along the southern edge of Case Road Pond. A sewer line extends east/west from Kitts Highway via Forrestal Avenue than along the south edge of the Case Road Pond to Bolsa Avenue where it exits the Refuge and extends further onto Navy land. Another sewer line and an adjacent water line extend along the west side of Kitts Highway and power lines and communication lines extend along the east side of Kitts Highway, all outside of the Refuge boundary.

4.5.5 Vectors and Odors

As described in Section 4.3.4.4, a number of mosquito species have been documented on the Refuge. All mosquitoes are generally considered vectors, and require some level of monitoring and possible control. Mosquito monitoring and control on the Refuge is implemented by the County of Orange in accordance with conditions included in a Special Use Permit issued to the County by the Refuge Manager (details regarding mosquito management on the Refuge is provided in Section 3.4.3.1). The County actively works with NWSSB and Refuge staff to monitor and when necessary control mosquito larvae on Refuge lands.

Given Anaheim Bay's status as a reasonably well-flushed coastal salt marsh, with healthy levels of dissolved oxygen, odors have not been a problem for nearby residents and visitors.

4.5.6 Economics/Employment

The Refuge is situated in the northwestern-most corner of Orange County near the Orange County/Los Angeles County border. Recent studies conducted by the Southern California Association of Governments (SCAG) regarding the regional economy for this area include the greater Southern California area of Los Angeles, Orange, Ventura, Riverside, San Bernardino, and

Imperial Counties. This region's diverse economic base includes foreign trade, motion picture production, tourism, apparel manufacturing, and software and professional services. In 2000, the estimated gross regional product was nearly $500 billion, representing the 12th largest economy in the world (*SCAG 2000*), and in 2008, the estimated gross regional product was $865 billon with a ranking of 16th among all national economies (*SCAG 2008*). Between 2000 and 2006, the region's job growth rates were better every year relative to the rest of the state and the nation (*SCAG 2007*). Some of this growth can be attributed to increases in housing wealth (due to higher home equity) and housing construction between 2000 and 2005. The region also experienced higher population growth than the rest of the nation between 2000 and 2006, which contributed to job growth in the retail trade, education, and health care (*SCAG 2007*). Figures that reflect the current downturn in the economy nationwide are not yet available, so it is unclear how these trends in estimated gross regional product or job growth have been affected over the past year.

The three largest job sectors in Orange County are professional/technical services, manufacturing, and retail trade (Table 4-15). In the State of California as a whole, the four largest sectors are educational, health, and social services; manufacturing; professional, scientific, management, administrative, and waste management services; and retail trade.

In 2006, the professional and business services section was the largest job generator in Orange County (*SCAG 2007*). In Los Angeles County, job growth in 2006 was attributed to the professional and business services, retail trade, logistics, and leisure and hospitality sectors (*SCAG 2007*). The average wage per job in Orange County in 2007 was $49,126 (*Stats Indiana 2008b*), while the real average wage per job in the region was $46,414 in 2006 (*SCAG 2007*).
The Refuge's effect on the overall economy within the region is nominal. Refuge staff includes one full time Refuge Manager and one part-time maintenance worker. The Refuge Manager is responsible for the daily operations of the Refuge including wildlife and habitat management and implementation of the limited public use program. The maintenance worker is responsible for the upkeep of maintenance buildings, vehicles, trails, and other property of the Refuge. Some of the activities conducted on the Refuge, such as monitoring of endangered species by consultants and predator management, are funded in whole or in part by the NWSSB. In addition, staff from NWSSB's Environmental Program provides assistance with management actions. Overall, Refuge expenditures are quite limited (approximately $167,000 per year), as listed in Table 4-16. In some years, expenditures can be greater depending upon the availability of funding for deferred maintenance projects or other special projects.

4.5.7 Environmental Justice

The goal of environmental justice in the United States is to afford the same degree of protection from environmental and health hazards to all individuals and communities throughout the nation. Environmental justice is defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of Federal, State, local, and tribal programs and policies. To achieve meaningful involvement requires that all potentially affected individuals have an appropriate opportunity to participate in decisions about proposed activities that could affect their environment and/or health and that the concerns of all participants are considered in the decision making process.

Table 4-15 Economic/Employment Data for Orange County, California					
Annual Industry Distribution of Jobs and Avg. Wage in 2006 (NAICS)	**Establishments**	**Jobs**	**Pct Dist. in County**	**Annual Average Wage Per Job**	**Rank in U.S.**
Total Covered Employment and Wages	95,046	1,514,873	100.0%	$49,126	69
Private	93,664	1,367,703	90.3%	$48,901	84
Agriculture, forestry, hunting	161	5,423	0.4%	$26,093	645
Mining	58	609	0.0%	$69,151	141
Construction	7,055	107,770	7.1%	$52,880	90
Manufacturing	5,531	181,796	12.0%	$59,139	178
Wholesale trade	7,245	83,172	5.5%	$67,640	61
Retail trade	9,314	161,164	10.6%	$32,079	28
Transportation, warehousing	1,277	D	D	D	N/A
Utilities	119	6,640	0.4%	$82,409	95
Information	1,394	32,102	2.1%	$66,781	84
Finance and Insurance	6,416	99,057	6.5%	$85,016	41
Real Estate, rental, leasing	4,943	D	D	D	N/A
Professional, technical services	13,910	110,946	7.3%	$70,285	126
Mgmt. of companies, enterprises	492	28,487	1.9%	$85,158	195
Administrative, waste services	4,708	137,223	9.1%	$31,282	288
Educational services	1,802	D	D	D	N/A
Health care, social assistance	8,912	D	D	D	N/A
Arts, entertainment, recreation	1,000	D	D	D	N/A
Accommodation and food services	6,002	D	D	D	N/A
Other services, exc. public admin.	14,386	D	D	D	N/A
Public administration	294	40,750	2.7%	$64,423	47

Source: (*US Bureau of Labor Statistics (BLS); Stats Indiana 2008a*)
D = Not shown to avoid disclosure of confidential information.
N/A = This item is not available.
Note: Average wage may not match published numbers due to rounding.

Table 4-16 Seal Beach NWR Staff and Budget (Estimate Based on FY2010)	
Expenditure	**Cost**
Refuge Salaries	$124,000
Maintenance and Operations	$43,000
TOTAL	**$167,000**

To understand the current proposal's potential effect as is relates to environmental justice, the following information is presented regarding the economic and ethnic composition of the communities that surround the Seal Beach NWR.

Orange County, California is about 790 square miles in size, and in 2006 the estimated population was three million, representing a population density of approximately 3,800 residents per square mile (*U.S. Census Bureau 2008*). According to the U.S. Census Bureau (*2008*), in 2002 approximately 47 percent of the population in Orange County identified themselves as white, 33 percent as Hispanic, 16 percent as Asian, 1.9 percent as African-American, 0.8 percent as American Indian or Alaska native, and 0.4 percent as native Hawaiian or other Pacific Islander. Over forty percent of the population in the County over the age of five speaks a language other than English in their home. This percentage is similar to the percentage for California as a whole.

Closer to the Refuge are the cities of Westminster, Garden Grove, Huntington Beach, Seal Beach, and Long Beach. Table 4-17 provides census data for each city and illustrates the differences in ethnic composition among of these cities and Orange County as a whole.

With respect to household income, Orange County had a median household income in 2004 of $58,605, which was above the median household income of $49,894 statewide in 2004. For the greater Southern California region, the median household income in 2006 was $55,678, which was below the median household income of $56,645 for the entire state in 2006 (*SCAG 2007*).

Table 4-17
Census Data for Areas in Proximity to Seal Beach NWR

Census Data	Westminster	Garden Grove	Huntington Beach	Long Beach	Seal Beach	Orange County
Total Population, 2006	89,520	166,296	194,436	472,494	24,157 (2000)	3,002,048
White, 2000	45.0%	46.9%	79.2%	45.2%	88.9%[1]	47.4%
Hispanic, 2000	22.0%	32.5%	14.7%	35.8%	6.4%[2]	32.9%
Asian, 2000	38.0%	30.9%	9.3%	12%	5.7%	16.1%
African American, 2000	1.0%	1.3%	0.8%	14.9%	1.4%	1.9%
American Indian or Alaska Native, 2000	0.6%	0.8%	0.7%	0.8%	0.3%	0.8%
Hawaiian or other Pacific Islander, 2000	0.5%	0.7%	0.2%	1.2%	0.2%	0.4%
Persons reporting two or more races, 2000	4.0%	4.1%	3.9%	5.3%	2.2%	2.0%
Those living below the poverty line, 1999	13.5%	13.9%	6.6%	22.8%	5.5%	10.2%

Source: (*U.S. Census Bureau 2008*).
[1] These data do not exclude people of Hispanic origin.
[2] These data include any race of Hispanic or Latino.

The U.S. Department of Housing and Urban Development (HUD) defines low income as 80 percent of the median household income for the area, subject to adjustment for areas with unusually high or low incomes or housing costs. According to the 2000 Census, the median

household income in 1999 dollars was $49,450 in Westminster, $47,754 in Garden Grove, $64,824 in Huntington Beach, $42,079 in Seal Beach, and $37,270 in Long Beach (*U.S. Census Bureau 2008*). This compares with an estimated region wide median household income in 1999 of $58,000. An income of $46,400 in 1999 dollars would represent 80 percent of the median family income for the region; therefore, based on the figures available, several of the communities that surround the Refuges would meet the definition of low income.

Poverty is defined as not having the economic resources needed to support a minimum acceptable standard of living. The poverty line is adjusted for family size. For example, in 2006, a family of four earning less than $20,444 a year, or a family of three earning less than $15,769, or a family of two earning less than $13,500, or an individual earning less than $10,488 is considered living in poverty. In California, 13.2 percent of all people were living in poverty in 2005 (*SCAG 2007*). Within the region, 13.6 percent of residents lived in poverty in 2006, with African American (20 percent) and Hispanic (19 percent) residents experiencing much higher poverty rates than non-Hispanic White (8 percent) and Asian (10 percent) residents (*SCAG 2007*). Orange County's poverty rate of 9.7 percent is the lowest of the six counties included within the southern California region (*SGAG 2007*).

5 Environmental Consequences

5.1 Introduction

This chapter provides an analysis and evaluation of the environmental consequences of implementing the alternatives described in Chapter 3. Impact evaluation has been conducted for each aspect of the environments described in Chapter 4 – Refuge Resources, including physical, biological, cultural, and socio-economic resources. The adverse and beneficial effects of each alternative are generally described under two main action categories – Wildlife and Habitat Management (including habitat enhancement/restoration) and Public Use. Cumulative effects on the environment of implementing the three alternatives are presented in Section 5.8.

5.2 Effects to the Physical Environment

Topics addressed under the physical environment section of this document include direct and indirect effects to topography, visual quality, geology and soils, mineral resources, agricultural resources, hydrology, and water quality, climate change and sea level rise, air quality, and greenhouse gas emissions.

The criteria used in this document to determine if a particular impact represents a significant adverse effect are present below for each topic.

- Topography – An adverse topographic effect is considered significant if grading or other land altering activity is proposed in a highly scenic area or would alter a locally or regionally important topographic landmark, or if any proposed activities would substantially alter the existing landform.

- Visual Quality – An adverse visual impact would be considered significant if a proposal would substantially alter the natural landform or block public views to a public resource such as the Pacific Ocean or Anaheim Bay.

- Geology/Soils – Impacts related to geology and soils would be considered significant if a proposed action would trigger or accelerate substantial slope instability, subsidence, ground failure, or erosion affecting onsite facilities or adjacent facilities, such as roadway embankments and bridge abutments. Impacts would also be considered significant if any proposed structures would be susceptible to geological hazards, such as liquefaction, settlement, ground rupture, or lateral spreading.

- Mineral Resources – Impacts to mineral resources would be considered significant if a proposed action could result in the loss of availability of a known mineral resource that would be of value to the region.

- Agricultural Resources – A significant adverse effect on agricultural resources would occur if a proposed Refuge action would impact adjacent Prime Farmland or cause the conversion of Prime Farmland to non-agricultural uses.

- Hydrology – An adverse hydrologic effect is considered significant if an action would result in increased storm and/or tidal flooding on- or off-site, a net deficit in the aquifer volume, a drop in the local groundwater table, or changes in tidal circulation that would trigger or accelerate slope/bank instability or erosion affecting facilities located both on and off the Refuge.

- Water Quality – Adverse impacts to water quality would be considered significant if the action would violate any water quality standards or waste discharge requirements, substantially increase sedimentation or turbidity in adjacent tidal waters, introduce contaminants (non-point source pollution) into the watershed, or otherwise substantially degrade water quality.

- Climate Change/Sea Level Rise – Although the proposals described in this document would have no influence over climate change or sea level rise, changing conditions associated with climate change and sea level rise could adversely affect Refuge resources or influence future Refuge management. The predicted effects of climate change and/or sea level rise could be significant if these effects would substantially alter or degrade sensitive habitats that support listed species, migratory birds, or other species of concern. In addition, effects of climate change and/or sea level rise would be considered significant if Refuge property, such as structures, trails, roads, signage, and other facilities, could be damaged or destroyed as a result of changing site conditions, including increasingly severe weather conditions.

- Air Quality – Direct adverse effects related to air quality would be considered significant if the action would result in emissions equal to or in excess of the NAAQS; sensitive receptors are exposed to substantial pollutant concentrations, including air toxics such as diesel particulates; or air contaminants are released beyond the boundaries of the Refuge. Significant indirect effects to air quality would occur if a proposed Refuge action results in the degradation of the existing level of service on adjacent roadways. Significant cumulative effects would occur if the "de minimis" (minimum) thresholds developed by the EPA for proposed Federal actions in a non-attainment area are exceeded.

- Greenhouse Gas Emissions – The Service has not developed a quantitative threshold for determining whether a project's greenhouse gas (GHG) emissions will have a significant effect on the environment and no statewide threshold has been adopted by the State of California. The California Air Pollution Officers Association (CAPCOA) in its publication "CEQA & Climate Change: Evaluating and Addressing Greenhouse Gas Emissions from Projects Subject to the California Environmental Quality Act" (*2008*) does explore various options for establishing significance thresholds for GHG emissions. These options include setting the threshold at zero and setting a non-zero level for GHG emissions. Another option involves addressing project effects without establishing a threshold. This could be accomplished through a quantitative or qualitative evaluation of individual projects. Because significance thresholds for GHG emissions have yet to be established, our significance determination is currently based on the specific context of an individual action. To the extent possible, our determination is based on a quantitative evaluation of the effects of the action's GHG emissions on the environment, including an estimate of the expected GHG emissions, and the extent to which efforts are made to reduce expected emissions.

- Contaminants – Adverse effects related to contaminants are considered significant when constituents of concern are present in the soil, groundwater, or surface water at levels that exceed standard screening levels for assessing ecological risk.

5.2.1 Alternative A – No Action

5.2.1.1 Effects to Topography/Visual Quality

Wildlife and Habitat Management

Conducting the wildlife and habitat management activities currently occurring on the Refuge, including monitoring of listed endangered and threatened avian species; management of NASA Island to support least tern nesting; trash and debris removal, culvert management, scientific research, and predator management would not result in adverse effects to topography.

Annual pre-nesting site preparation for the California least tern involves removing weedy vegetation from the NASA Island nesting site and improving substrate quality when necessary by spreading additional clean, light sand and shell fragments over some or all of the site; and addressing any erosion problems around the outer edges of the nesting site. The continuation of these types of actions would result in negligible changes to the topography within the nesting site; therefore, no adverse effects related to topography would occur.

Current Refuge wildlife and habitat management activities that could affect visual quality include the removal of weeds, repair to subsurface culverts, removal of trash and debris, installation of clapper rail nesting platforms, and yearly maintenance at the NASA Island California least tern nesting site. While some of these activities, including vegetation removal associated with culvert maintenance and control of invasive species, may change the visual character of the affected areas; these impacts are temporary in nature and result in only minor changes to the Refuge's visual quality. Following construction, affected areas are replaced with appropriate native vegetation and areas where invasive species are controlled are replanted with native upland species. These actions serve to mitigate temporary changes in the visual character of the site. Therefore, continuation of these management activities would not result in significant adverse effects to visual quality. Some minor beneficial effects would be expected as a result of trash and debris removal and the replacement of weedy species with native plants.

Public Use

No changes to the existing topography within the Refuge occur as a result of conducting the existing limited public use program on the Refuge; therefore, no impacts to topography related to public use would occur under this alternative.

The facilities provided on the Refuge to accommodate public use include a pedestrian pathway along the south side of Bolsa Avenue east of Kitts Highway, an observation deck at the end of the pathway, low interpretive signage along the pathway and at the deck, and a kiosk to the north of the Refuge office/visitor contact station. None of these facilities block views of the Refuge, nor do they create any significant adverse effect to the visual quality of the Refuge.

5.2.1.2 Effects to Geology/Soils

Wildlife and Habitat Management

None of the wildlife and habitat management activities currently occurring on the Refuge would trigger or accelerate substantial slope instability, subsidence, ground failure, or erosion, nor would they make the Refuge and its facilities any more susceptible to geological hazards, such as

liquefaction, settlement, ground rupture, or lateral spreading. Therefore, no adverse effects related to geology or soils are anticipated under this alternative.

Public Use

Existing soil and geological conditions on the site do not pose a hazard, nor do these conditions adversely affect the function of the pathway that provides access for the public from the Refuge office/visitor contact station to the observation deck or the observation deck itself. Therefore, the facilities used in association with the existing public use program would not be impacted as a result of the geological or soil conditions on the Refuge.

5.2.1.3 Effects on Mineral Resources

Continuing current management practices and public use programs on the Refuge would have no effect on the ongoing oil extraction operation at Oil Island.

5.2.1.4 Effects to Agricultural Resources

Wildlife and Habitat Management

Lands identified as Prime Farmland occur immediately adjacent to the Refuge and these lands are currently being farmed under the authority of the U.S. Navy. The continuation of wildlife and habitat management activities and public use programs currently occurring on the Refuge would have no effect on these ongoing farming operations. No effects to adjacent agricultural resources are therefore anticipated under Alternative A.

5.2.1.5 Effects to Hydrology

Wildlife and Habitat Management

The primary management activities occurring on the Refuge that could have an effect on the hydrology in and around the Refuge involves the repair and replacement of existing culverts that facilitate tidal flows in and out of the restored wetland areas on the Refuge. These repairs are intended to maintain, and in some cases restore, tidal circulation between the main marsh complex and the restored subtidal areas of Forrestal, Case Road, 7th Street, and Perimeter Ponds, as well as improve tidal circulation within the marsh to levels that existed prior to culvert deterioration. The activities would not result in any significant adverse changes to the hydrological conditions within the Refuge. As described in Chapter 4, erosion resulting from tidal action and wind waves, along with other factors, is occurring along the banks of Forrestal Pond, Case Road Pond, and the mitigation channel to the west of the Bolsa Cell. No actions are proposed under Alternative A to address this issue; therefore, erosion of the banks would be expected to continue under this alternative.

Public Use

The existing public use program does not involve any activities that would impact hydrology within or outside of the Refuge; therefore, there would be no effect to hydrology from the continuation of the existing public use program on the Refuge.

5.2.1.6 Effects to Water Quality

Wildlife and Habitat Management

BMPs are currently implemented by Refuge staff as necessary during culvert maintenance activities to minimize erosion and sedimentation into adjacent wetlands. These BMPs (e.g., fiber rolls, silt fencing, cofferdams) are implemented during repairs to culverts, as well as other maintenance activities occurring in areas upstream or adjacent to the marsh. The continued implementation of these types of measures would minimize or avoid water quality impacts to the coastal wetlands on the Refuge, as well as the adjacent Anaheim Bay. Monitoring and cleanup of

environmental contaminants on the Refuge would continue to be directed by NWSSB and the Service's Contaminants Program at the Carlsbad Fish and Wildlife Office to ensure that potential contaminants issues are appropriately addressed as part of the Refuge's overall management plan.

Pest Management

The control of invasive plant species on the Refuge involves mechanical removal and the periodic application of herbicides, particularly in the disturbed upland areas that border the marsh. Although mechanical removal has the potential to expose soils to wind and water erosion, these activities are generally limited to the use of hand tools and focus on individual plant removal, rather than the removal of large areas of vegetation. Therefore, the continuation of mechanical control methods is not expected to impact water quality within adjacent wetland areas.

Section 569 FW1 of the Service Manual requires that before any insecticide, herbicide, fungicide, or other pesticide can be used on a Refuge, a pesticide use proposal (PUP) must be prepared and approved for use. The Service uses this formal pesticide use review process to ensure that all chemical pesticides approved for use have been reviewed for their potential impacts to groundwater, surface water and terrestrial and aquatic non-target vegetation and wildlife, including threatened and endangered species. All PUPs, which are stored in the Pesticide Use Proposal System, identify specific pesticides, such as herbicides and mosquito control products, proposed for use on a Refuge, as well as details on target pests, products applied, application dates, rates, methods, number of applications, site description, sensitive habitats, and best management practices employed to avoid impacts to Refuge resources. Pesticides approved for use must be shown to pose the lowest toxicity-related threat to non-target terrestrial and aquatic ecosystems, while addressing the specific pest control objectives. The pesticides currently approved for use on the Seal Beach NWR are described in greater detail in Chapter 3.

The use of herbicides to control invasive plants could also pose several environmental risks, including water contamination and persistence in the environment (*Bossard et al. 2000*). The potential for such risks under this alternative are considered minimal due to the types, limited quantities, and use restrictions that have been established for each herbicide used on the Refuge. In all cases, the application of a pesticide product must be conducted in accordance with the specifications on the product label. Further, through the PUPs review process, as described in Appendix C, each product to be used on the Refuge, as well as the proposed application quantities and proposed number of applications per season is reviewed to ensure that no adverse effects to Refuge resources, including water resources, will occur as a result of the application of a particular product. When necessary to ensure adequate protection for sensitive resources, application amounts or the number of applications per season are reduced and/or buffer areas are established to adequately separate sensitive habitat areas from treated areas.

Aquamaster and Glyphosate Pro 4, both with the active ingredient glyphosate, are used on the Refuge to control post-emergent invasive plants. Aquamaster is permitted for use adjacent to wetlands, while Glyphosate Pro 4 is permitted for use in upland areas. Although glyphosate is highly soluble in water, it is also strongly adsorbed to suspended organic and mineral matter, which greatly reduces the potential for groundwater contamination. There is however some risk of surface water contamination from aquatic use of this product, as well as the risk of short term impacts to water quality should soil from treated areas erode into adjacent wetlands. To minimize the potential for impacts to water quality as a result of applying glyphosate on the Refuge, Glyphosate Pro 4 is only used in terrestrial environments and is not applied if rain is predicted within 24 hours of proposed application. In addition, a buffer area between all treated areas and sensitive habitats, particularly wetlands, is maintained during the application of Aquamaster.

Surflan AS, with the active ingredient oryzalin, is soluble in water and does not have a strong tendency to adsorb to soil particles. It leaches downward to a limited extent with rainfall and has a moderate potential to contaminate groundwater. To minimize the potential for impacts to water quality, Surflan AS is only used in upland areas. The implementation of the following BMPs when using this product would further reduce the potential for water quality impacts: reduce the number of applications to one per year at an application rate of 1.5 pound of active ingredient per acre per year; maintain a minimum 25-foot buffer between all upland treatment site(s) and the high water mark of the nearest wetland area; and avoid the application of oryzalin to sites that are upslope of any surface water resources when the slope gradient is greater than 17 percent.

Sunlight breaks down imazapyr, the active ingredient in Habitat, very quickly in water. This product is considered a reduced risk herbicide that is permitted for use in uplands, riparian and aquatic habitats. It is used on the Refuge primarily for control of invasive, terrestrial plants and no impacts to water quality from the use of this product are anticipated.

Under Alternative A, mosquito monitoring and control would continue to be conducted by OCVCD. Monitoring and surveillance activities would not affect water quality because this work is conducted by driving on existing roads and walking where no roads are present. As a result, there is limited potential for ground disturbance that could result in siltation or erosion of soils into adjacent wetland areas. In addition, no contaminants would be introduced into the Refuge's wetlands as a result of this activity.

The application of pesticides on the Refuge to control mosquitoes could affect water resources, because pesticide application to control mosquitoes occurs in an aquatic environment, specifically coastal salt marsh habitat. The products currently being used on the Refuge include Altosid Briquets and Altosid Pellets WSP, with the active ingredient methoprene; VectoBac 12AS and VectoBac G, both with the active ingredient *Bacillus thuringiensis israelensis*, and VectoLex WDG, with the active ingredient *Bacillus sphaericus*.

According to the Ninth Circuit Court (Headwaters, Inc. v. Talent Irrigation District (9th Cir. 2001) 243 F.3d 526), aquatic pesticides that are applied to waters of the United States in accordance with FIFRA label requirements are not considered pollutants; however, pesticides or by-products that persist in or leave the area of treatment after a specified treatment period are considered pollutants and require coverage under a National Pollutant Discharge Elimination System (NPDES) Permit. Currently, aquatic pesticides applied to surface waters of the United States for vector control are covered in California under NPDES General Permit No. CAG990004. Each discharger seeking coverage under this General Permit is required to submit a Monitoring Plan for approval by the appropriate RWQCB and must implement the monitoring plan as approved. The OCVCD has coverage under this General Permit.

The USEPA and California Department of Pesticide Regulation require that aquatic pesticides undergo toxicity testing and meet specific toxicity requirements before registering the pesticide for application to surface waters. USEPA has found that the application of properly registered aquatic pesticides pose a minimum threat to people and the environment. Additionally, the effects of these pesticides on water quality will be mitigated through compliance with FIFRA label requirements, and monitoring.

To mitigate potential effects to water quality resulting from pesticide applications, the NPDES General Permit requires that dischargers implement BMPs when conducting aquatic vector control programs. Dischargers are required to consider feasible alternatives to applying selected aquatic pesticides if the alternatives would reduce potential water quality impacts. If alternatives

are identified that could reduce potential water quality impacts and they are also feasible, practicable, and cost-effective, the discharger is required to implement the identified alternative measures. One effective BMP identified in the General Permit is the use non-toxic and less toxic controls. These include larvicides with very low toxicity that pose very little or no threat to the environment. USEPA has concluded that microbial larvicides (e.g., Bacillus thuringiensis israelensis, Bacillus sphaericus) do not pose risks to the environment; and methoprene, as used in vector control programs, does not pose unreasonable risks to the environment (*California State Water Resources Board 2004*). Therefore, the current vector control practices being conducted on the Refuge are not expected to result in any adverse effects to water quality.

Public Use

The pathway that provides access for the public from the Refuge office/visitor contact station to the observation deck consists of decomposed granite installed along a relatively flat surface. No signs of erosion along the pathway are evident and the pathway continues to provide a firm and stable surface, therefore, the continuation of the public use program currently conducted on the Refuge would have little, if any, effect to water quality in the adjacent wetlands.

5.2.1.7 Effects from Climate Change/Sea Level Rise

Overview

Climate change, especially sea level rise, will significantly alter the existing conditions on the coast, making coastal intertidal habitats, including the salt marsh habitat protected within the Seal Beach NWR, some of the most at risk habitats in the world. As sea level rises, intertidal mudflats and salt marsh habitat will be converted to subtidal habitat. In addition, decreases in precipitation could adversely affect the health of the remaining cordgrass and other salt marsh vegetation that depends on some seasonal freshwater input to promote plant vigor.

Although global sea level rise is well-documented, as described in Section 4.2.5.2, there are currently no clear answers regarding how fast and to what extent sea level rise will impact these existing habitats. This makes it difficult to establish specific long-term management strategies for protecting this important habitat. We must instead rely on adaptive management to help us identify measures to insure that coastal intertidal habitat and the wildlife it supports can persist at some level as conditions change.

In an effort to better understand the potential effects of sea level rise on the habitat at the Seal Beach NWR, the Service contracted the application of the Sea Level Affecting Marshes Model (SLAMM) for the refuge. SLAMM 5.0.1, which accounts for the dominant processes involved in wetland conversion and shoreline modifications during long-term sea level rise, predicts the changes in tidal marsh area and habitat type as a result of sea level rise (*Park et al. 1989; www.warrenpinnacle.com/prof/SLAMM*). The primary set of global sea level rise scenarios used within SLAMM was derived from the work of the IPCC (*IPCC 2001*) and was run using the IPCC and fixed-rate scenarios presented in Table 5-1. These scenarios, which include new information related to assumptions of one meter and 1.5 meters of global sea level rise by the year 2100 (*Chen et al. 2006, Monaghan et al. 2006*), indicate that global sea level may be rising progressing more rapidly than was previously assumed. The A1B maximum (A1B Max) scenario incorporates the suggestion by Rahmstorf (*2007*) that a feasible range by 2100 might be 50 cm (19.7 inches) to 140 cm (55.1 inches).

The SLAMM analysis for the Seal Beach NWR also incorporated a number of other factors including: digital elevation mapping derived from LIDAR and ifSAR data from 2003 and 1998, respectively; 2005 wetland boundary data from the National Wetlands Inventory; historic trends in

sea level rise in the general vicinity of the Refuge; the approximate tidal range at the site; salt marsh accretion rates; and the assumption that all of the Refuge's tidally influenced habitats have unrestricted tidal flow (*Clough and Larson 2008*). The historic trend for sea level rise in the general vicinity of the Refuge was estimated at 1.5 mm/year (0.059 inches/year) using the average of the three closest stations (9410660, Los Angeles California; 9410580, Newport Beach California; 9410840, Santa Monica California). There are no long-term sea level trend data available for the gage at Long Beach CA. The measured rate at this location is roughly equal to the global average for the last 100 years.

Table 5-1
Scenarios Used to Run SLAMM 5

Scenario	Global SLR[1] by 2025 (cm)	Global SLR[1] by 2050 (cm)	Global SLR[1] by 2075 (cm)	Global SLR[1] by 2100 (cm)
A1B Mean	8	17	28	39
A1B Max	14	30	49	69
1 meter	13	28	48	100
1.5 meter	18	41	70	150

[1] Sea Level Rise
Source: (*Clough and Larson 2008*)

The tide range at the Refuge was estimated at 1.67 meters using the average of the four closest NOAA oceanic gages (9410660, Los Angeles California; 9410580, Newport Beach California; 9410680, Long Beach, Terminal Island California; 9410650, Cabrillo Beach California). The USGS topographical map for this region suggests an approximate tidal range of four feet (1.22 meters) (*Clough and Larson 2008*).

The salt marsh accretion rate used in the model for this site was 2 mm per year (0.079 inches per year), which represents the low end of measured accretion rates for salt marsh. This rate was deemed appropriate because freshwater input into the marsh is extremely limited and subsidence has occurred in the area in the past. The rate of 2 mm per year does account for biogenic production and the possibility that increased sea level rise will deliver additional sediment to the Refuge (*Clough and Larson 2008*).

Although the results of the SLAMM for the Seal Beach NWR indicate that the Refuge would have differing degrees of vulnerability to sea level rise depending on the scenario of sea level rise analyzed, the results confirm that the Refuge will be adversely affected by sea level rise in all scenarios. Under the most conservative sea level rise scenario (A1B Mean), 0.39 meter (1.28 feet) by 2100, roughly one quarter of the Refuge's salt marsh habitat would be converted to subtidal habitat. The amount of salt marsh acres lost to habitat conversion increases to two thirds under scenario A1B Max, a 0.69 meter (2.26 feet) rise by 2100, and nearly one hundred percent of the salt marsh habitat would be lost under scenarios that assume a rise of greater than one meter (3.28 feet). The small quantity of undeveloped dry land on the Refuge is predicted to be vulnerable under all scenarios run, while the developed dry land was assumed to be maintained and protected in this analysis (*Clough and Larson 2008*).

A review of results presented in Table 5-1 indicates that under the sea level rise scenario adopted by the California Coastal Conservancy Board (40 cm [16 inches] by 2050 and 140 cm [55 inches] by 2100) roughly one quarter of the salt marsh habitat on the Refuge would be converted to subtidal

habitat by 2050 and all of the salt marsh habitat and undeveloped upland areas would be converted to subtidal habitat by 2100.

Wildlife and Habitat Management

Under Alternative A, the Refuge would continue to be managed as it is today, with no specific actions being taken to address sea level rise. However, management actions such as the monitoring of the Refuge's light-footed clapper rail population and conducting monthly avian surveys could provide some insight into how sea level rise may be affecting wildlife resources on the Refuge.

Over the next 15 years, it is likely that the effects of sea level rise (e.g., higher high tide elevations, increases in the frequency of surface flooding due to higher high tides that occur during storm events) will become more evident. However, the effects of sea level rise over the next 15 years are not anticipated to adversely affect Refuge resources.

As time goes on, these effects are expected to become progressively more profound. Based on the results of the SLAMM, sea level rise over the next 25 to 100 years could inundate the cordgrass habitat on the Refuge; adversely impacting the light-footed clapper rail and the habitat that supports this species. In addition, the condition of existing culverts serving the restoration areas of the Refuge could be degraded as a result of increased tidal elevations. Wind and wave erosion would also be expected to increase along the slopes located adjacent to the restored area at the north end of the Refuge, as well as around the perimeter of NASA Island. Actions to address these impacts will be required at some point in the future, possibly requiring major revisions to the Refuge goals and objectives to address the changes associated with sea level rise.

Public Use

The SLAMM assumes that the developed dry land within the Refuge (e.g., areas supporting streets, buildings, and other facilities) would be maintained and protected; however, there are no assurances that this will in fact be the case. Bolsa Avenue, which includes a public use trail along its western edge, is already subject to tidal flooding during extreme high tides. The cost of protecting this road from more frequent inundation may be excessive and would likely be the responsibility of the Navy. Therefore, the trail, an existing observation deck, and interpretive signs that have been installed along the length of the trail would be subject to damage as a result of sea level rise. These effects are not anticipated to occur over the next 15 years, but are anticipated to occur at some point in the future. At such time as inundation becomes too frequent, these facilities would have to be abandoned or relocated. Monitoring of tidal elevations over time will provide insight into when plans should be initiated to address the removal and/or relocation of these existing facilities. Opportunities for wildlife observation, interpretation, and environmental education would however continue to be available despite the effects of sea level rise. No new facilities are proposed under Alternative A; therefore, the anticipated impacts to the Refuge's public use facilities would be limited to those facilities that are already present on the Refuge.

5.2.1.8 Effects to Air Quality

Wildlife and Habitat Management

Current wildlife and habitat management activities on the Refuge require the use of motorized vehicles for access to various project sites, to accommodate habitat and species monitoring, to deliver tools, supplies, and other equipment to habitat management sites, and for removing trash and debris from the marsh. The staff on the Refuge consists of one full-time Refuge Manager and a part-time maintenance worker, generating approximately 32 vehicle trips to and from the Refuge per week. Refuge volunteers who assist at the Refuge generate an estimated 20 additional trips

per week. The sum of these activities contributes extremely low levels of air quality emissions and the pollutions generated as a result of these activities are considered negligible in the context of the larger air basin regulated by the South Coast Air Quality Management District.

Pest Management

Several pesticides are used on the Refuge including herbicides to control invasive plants and insecticides, applied by OCVCD, to control mosquitoes. Pesticides in general can volatilize from soil and plant surfaces and move from the treated area into the atmosphere. The potential for a pesticide to volatilize is determined by the pesticide's vapor pressure. Surflan AS, VectoBac 12AS, VectoBac G, and VectoLex WDG are considered non volatile, while Altosid, Aquamaster, Glyphosate Pro 4, and Habitat are volatile. Because all of these products are used at such low volumes on the Refuge, even the volatile products quickly become diluted in the atmosphere, minimizing the effect on local air quality. The potential for adverse air quality impacts as a result of pesticide use is also lessen through compliance with all federal, state, and local pesticide use laws and regulations, as well as Departmental, Service, and NWRS pesticide-related policies. This includes compliance with the Federal Insecticide, Fungicide and Rodenticide Act of 1996 (FIFRA), which requires all pesticides to be applied at the rates and with the application equipment specified on the pesticide label. The use of herbicides on the Refuge also requires the implementation of BMPs developed as part of the PUP review process. These include restricting herbicide application to periods when wind speeds are less than ten miles per hour and no inversion conditions exist.

Based on the analysis provided above and the actions taken to minimize potential effects, the implementation of the habitat and pest management proposals included under Alternative A will not adversely affect air quality.

Public Use

The public use program currently conducted on the Refuge generates vehicular emissions as a result of visitors traveling to and from the Refuge for monthly tours and other special events. In addition, Service vans are used to transport visitors onto the Refuge from outlying parking areas. The total number of trips, if calculated on a per week basis, would total approximately 45 trips per week. In the context of the emissions generated throughout the air basin, these emissions are negligible. Therefore, continuation of the current public use program would not adversely affect air quality.

5.2.1.9 Effects Related to Greenhouse Gas Emissions

The scientific community overwhelmingly agrees that the earth's climate is becoming warmer, and that human activity is contributing to this change. Unlike other environmental impacts, climate change is a global phenomenon, in which large and small GHG generators throughout the earth contribute to the impact. Therefore, although many GHG sources are individually too small to make any noticeable difference to climate change, the number of small sources around the world combine to produce a very substantial portion of total GHG emissions (*CAPCOA 2008*).

On February 23, 2010, the Council on Environmental Quality (CEQ) issued draft guidance on when and how Federal agencies should analyze the environmental effects of GHG emissions and climate change when they describe the environmental impacts of a proposed action under NEPA. As part of this draft guidance, CEQ proposes to advise Federal agencies to consider whether analysis of direct and indirect GHG emissions from a proposed action may provide meaningful information to decision makers and the public. CEQ is suggesting that direct emissions of 25,000 metric tons or more of CO_2-equivalent GHG emissions on an annual basis should be considered the indicator that a quantitative and qualitative assessment may be warranted. This annual volume of GHG

emissions is not however intended to be an indicator of a threshold of significant direct or indirect effects. Further, CEQ does not propose to make this guidance applicable to Federal land and resource management actions and is instead seeking public comment on the appropriate means for assessing the GHG emissions of Federal land and resource management decisions.

At the state level, various options are being considered for setting a threshold for GHG emissions in California including zero and non-zero levels, while another option involves addressing project effects without establishing a threshold. The latter could be accomplished through a quantitative or qualitative evaluation of individual projects.

Activities that would occur on the Refuge under Alternative A that would emit GHGs include the use of vehicles by staff and volunteers to get to and from the Refuge, the use of vehicles by visitors to the Refuge, the use of motorized equipment to implement management actions, the occasional use of trucks to provide supplies to the Refuge, and the use of electricity for power and heat within the Refuge office. Quantifying the amount of GHG emissions generated from these types of uses is difficult; however, through the use of the USEPA's Greenhouse Gas Equivalencies Calculator (*USEPA 2009*), it is possible to get a general idea of the magnitude of the emission associated with such uses. To obtain an estimate the number of metric tons of CO_2 emissions that could be generated annually as a result of implementing Alternative A, we estimated the number of miles traveled by Refuge staff, visitors, and volunteers to get to and from the Refuge on an annual basis and then translated in gallons of gasoline consumed per year as a result of this travel. Based on data provided by the USEPA Calculator, approximately 42 metric tons of CO_2 emissions would be generated annually as a result of these trips. The operation of the Refuge Office/Visitor Contact Station requires approximately 14 kilowatt hours per month (168 kilowatt hours per year), which represents about 0.12 metric tons of CO_2 emissions per year (*USEPA 2009*). Based on these calculations, Alternative A would be expected to generate annual GHG emissions generally equivalent to the annual GHG emissions generated by eight passenger vehicles.

Another aspect of Alternative A is the proposal to protect and manage native habitats on the Refuge. The majority of the Refuge supports salt marsh habitat, which is considered very effective in removing carbon from the atmosphere and storing it in marsh soils (*Chmura, et al. 2003*). Further, unlike freshwater marshes, tidal salt marshes release only negligible amounts of methane, a powerful greenhouse gas, so the overall benefits of carbon sequestration provided by salt marsh are great (*Brevik and Homburg 2004*).

In the absence of more specific guidance on how to determine a level of significance, we have compared the level of GHG emissions from this proposal to other types of GHG emission generators, as well as considered the carbon sequestration benefits of the salt marsh habitat present on the Refuge. Based on these factors, we have concluded that given the very low levels of GHG emissions that would result from the implementation of Alternative A, the GHG emissions from this project do not represent a significant direct or indirect impact on the environment.

5.2.1.10 Effects Related to Contaminants

Wildlife and Habitat Management

Under Alternative A, the primary ground disturbing activity that would continue to occur on the Refuge is the planting of native vegetation following invasive plant species control. This activity generally occurs in upland areas around the eastern perimeter of 7th Street Pond, on the outer edges of Hog Island, and other disturbed upland areas on the perimeter of the Refuge. Areas identified by the Navy through their Installation Restoration program that could contain

contaminants related to past military activities are avoided to ensure no adverse effects related to contaminants.

Prior studies conducted on the Refuge by the Navy as part of their Installation Restoration program identified total petroleum hydrocarbon and chromium levels that exceeded State Water Resources Control Board designated levels to protect marine waters. Additionally, in 1995 a study was completed to assess the effects of operations at NWSSB on the biota of the Refuge's salt marsh habitat. This study focused on the potential bioaccumulation of chemicals in species that are primary food items of the California least tern and light-footed clapper rail. Although observed contaminant levels in primary food items did not warrant a concern for immediate remediation, levels were sufficient to potentially produce sublethal effects in the least tern and clapper rail. Because a major pathway for contaminants of concern, including cadmium, chromium, copper, lead, nickel, zinc, DDE, and polychlorinated biphenyl (PCB), are erosion and runoff from surrounding upland areas, the draft INRPM for NWSSB (*U.S. Navy 2011*) recommends further monitoring to assess bioaccumulation of chemicals in these species particularly in the northwest and southeast areas of the Refuge.

Public Use

No contaminants are known or expected to be present in areas used by the public as part of the public use programs currently conducted on the Refuge.

5.2.2 Alternative B – Maximize Salt Marsh Restoration, Continue Current Public Uses

Under Alternative B, the wildlife and habitat management activities described in Alternative A would be expanded to include additional activities intended to protect and aid in the recovery of the light-footed clapper rail and California least tern; to increase our understanding of the array of species present within the Refuge and their relationship with other species and existing habitats; to broaden our understanding of how the Refuge's trust resources are being affected by climate change and sea level rise; and to restore the remaining disturbed habitat areas on the Refuge to functional salt marsh and wetland/upland transition habitat. This alternative also includes the implementation of an IPM Plan and a Mosquito Management Plan. No changes to the public use program described in Alternative A would occur under this alternative.

5.2.2.1 Effects to Topography/Visual Quality

Wildlife and Habitat Management

Each of the management activities conducted under Alternative A would also occur under Alternative B. None of these would result in adverse effects to topography. In addition, Alternative B calls for restoration of salt marsh and wetland/upland transitional habitats in several locations around the Refuge. The proposed restoration sites include: approximately 20 acres of land located to the north of Case Road Pond; one acre on the eastern-most island in the Case Road Pond; ten acres to the southeast of 7th Street Pond; and five to six acres located along the western edge of 7th Street Pond and around the existing drop tower at the southern end of 7th Street.

Restoration of the areas to the north of Case Road Pond and southeast of 7th Street Pond would involve the removal of fill material to achieve elevations supportive of the type of habitat proposed for each site. The Case Road site, the area to the southeast of 7th Street Pond, and the area to the east of the drop tower would be restored to a range of sub-tidal, intertidal mudflat, salt marsh, and wetland/upland transitional habitat, while the area to the west of 7th Street Pond and west of the drop tower would be restored to wetland/upland transitional habitat. Conventional land

excavators, motor graders, and dump trucks would be used to achieve the desired elevations and excess material would be removed to an appropriate offsite location.

The salt marsh restoration sites near Case Road and 7th Street would be designed and constructed to include meandering subtidal swales that would extend from the existing edge of the subtidal habitat through the range of salt marsh zones (i.e., low, middle, and high) that would be created. The swales would be constructed to include broad side slopes to support increased habitat diversity.

The sum total of these proposed restoration efforts would be to change the topography and elevations on approximately 36 acres of the Refuge. These changes would not however be adverse, as they would not negatively modify a highly scenic area nor would they affect a locally or regionally important topographic landmark. Neither would the proposed grading substantially alter the existing landform by creating manufactured slopes higher than ten feet or steeper than 2:1 (50 percent).

Alternative B calls for restoration of salt marsh and wetland/upland transitional habitats at several sites around the Refuge, the replacement of existing culverts in the Bolsa Cell with a new water control structure, and the removal of concrete and other debris from the marsh. At present, the restoration sites, as well as the upland area to the east of 7th Street Pond, are dominated by non-native, invasive upland plants. Conventional land excavators, motor graders, and dump trucks would be used to achieve the desired elevations in the restored areas. Excess material from the restoration site, as well as concrete and other debris removed from the marsh, would be removed to an appropriate offsite location using dump trucks. While grading activities in the restoration areas are underway, there would be temporary, minor adverse effects to visual quality. However, once grading has concluded and the sites have had the chance to be restored to native salt marsh and transitional habitats, visual quality would be improved over the present condition.

No substantive change in the appearance of the levee in the Bolsa Cell would result from the replacement of the existing culverts with a new water control structure, and removal of the 1,400 to 1,600 metric tons of concrete debris from the marsh would have a beneficial effect. Overall, Alternative B would have a long-term, beneficial impact on visual resources at the Refuge.

Public Use

No changes to the current public use program are proposed under Alternative B, therefore, as described under Alternative A above, no impacts to topography or visual quality would result from the continuation of the limited public use program that is currently conducted on the Refuge.

5.2.2.2 Effects to Geology/Soils

Wildlife and Habitat Management

As noted in the sections above, each of the management activities conducted under Alternative A would also occur under Alternative B. None of these activities would trigger or accelerate substantial slope instability, subsidence, ground failure, or erosion, thus affecting onsite facilities or adjacent facilities, such as roadway embankments and bridge abutments and pilings. Alternative B proposes to expand existing management activities to include habitat restoration in several locations within the Refuge. Restoration of salt marsh and wetland/upland transitional habitats could temporarily expose soil to wind and water erosion if Best Management Practices (BMPs) are not implemented during construction. To avoid such impacts, all restoration construction specifications would include the requirement to implement appropriate BMPs for erosion and sediment control during construction to minimize the potential for water and wind

erosion at the project site. In addition, all slopes associated with future restoration would have a slope gradient of 4:1 or flatter to avoid the potential for erosion in the future. The restoration of portions of the Refuge's upland areas would have no effect on the site's current susceptibility to geological hazards, such as liquefaction, settlement, ground rupture, or lateral spreading.

To avoid erosion and soil loss during the installation of a new water control structure in the levee to the west of the Bolsa channel, BMPs such as the use of silt fencing, cofferdams, straw wattles, and filter fabric to protect exposed soil would be implemented during project construction. The slopes adjacent to the structure would be protected from erosion through the use of rip rap or native vegetation as deemed appropriate during final design.

The implementation of appropriate BMPs during habitat restoration would reduce the potential for impacts to soil erosion to below a level of significance. Additionally, the restoration proposals included in Alternative B would not trigger or accelerate substantial slope instability, subsidence, ground failure, or erosion that could adversely affect onsite facilities or adjacent facilities, such as roadway embankments and bridge abutments and pilings.

Public Use

The continuation of the limited public use program as currently conducted at Seal Beach NWR would not adversely affect geology or soils for the same reasons described under Alternative A.

5.2.2.3 Effects to Mineral Resources

The wildlife and habitat management proposals included under Alternative B include working with the Navy and others to reduce the number of avian predator perching sites on and adjacent to the Refuge. At present, above-ground power poles extend along the northern access road to Oil Island. To implement the proposal to reduce perching sites would require coordination with the operator of the Oil Island site. Adding anti-perching features to the tops of the existing poles is not expected to result in any adverse effects to the ongoing oil extraction operations at Oil Island. Alternative B does not include any new public use proposals; therefore, as described in Alternative A, no adverse effects to the operations at Oil Island would occur as a result of continuing the current public use programs on the Refuge.

5.2.2.4 Effects to Agricultural Resources

Wildlife and Habitat Management

Under Alternative B, there is a proposal to work with the Navy to create a buffer around the outer boundary of the Refuge where invasive plant species would be controlled in an effort to reduce the potential for reinvasion of restored upland areas on the Refuge by non-native weedy plants. Although this effort could extend a few feet into existing agricultural areas, the potential effects to existing agricultural operations would be minimal.

Public Use

The continuation of the limited public use program currently conducted on the Refuge would not result in any significant adverse effects to nearby farming activities on the NWSSB.

5.2.2.5 Effects to Hydrology

Wildlife and Habitat Management

Implementation of the proposal to expand salt marsh and wetland/upland transition habitat on much of the remaining upland areas within the Refuge would result in the restoration of tidal influence to areas that were historically subject to tidal action. The proposed restoration would have no effect on the limited freshwater drainages that enter the Bay from the north and would

result in only minor changes to the hydrology in Anaheim Bay. These proposals could however result in localized changes to the existing hydrology within the Refuge warranting additional study prior to restoration. Specifically, the proposal to restore approximately 20 acres just to the northeast of Case Road Pond would result in a minor expansion of the tidal prism in the area north of Bolsa Avenue. This could in turn increase the volume of water flowing through the existing culverts that connect Case Road Pond to the unrestricted portion of Anaheim Bay, located to the south of Bolsa Avenue.

To ensure that the rate of flow through these culverts during incoming and receding tides would not create the potential for erosion around the existing culverts, modeling would be conducted in conjunction with restoration engineering to determine the anticipated flow rates at the culverts. This modeling effort would also evaluate the adequacy of the other culverts in the area to handle the anticipated flows. Should the results of this modeling indicate the potential for erosion, appropriate measures, such as altering the restoration design to reduce tidal velocities and/or armoring the areas around the affected culverts to minimize the potential for erosion, would be incorporated into the final restoration design.

As described in Chapter 4 (Section 4.2.5.1), the culverts that convey tidal flows into the western portion of the Bolsa Cell from the mitigation channel are in very poor condition, showing significant signs of deterioration. To correct this problem and address past concerns related to how much tidal flow should be permitted within the Bolsa Cell, Alternative B proposes to remove the deteriorated culverts, repair the levee, and rather than replace the existing culverts, install a new water control structure near the center of the levee.

The replacement of the existing culverts with a new water control structure would eliminate unregulated fluctuations in tidal flow, as experienced in the Bolsa Cell since 1990. This will enable Refuge staff to protect habitat for the Belding's savannah sparrow, while also improving habitat in the cell for the light-footed clapper rail. It will also allow regulation of water levels during periods of heavy rainfall and higher high tides to protect existing structures to the east of the Bolsa Cell from flooding. Prior to the completion of final design for the water control structure, a numerical model of the tidal hydraulics in the Bolsa Cell under existing conditions and in the future assuming the construction of a new water control structure will be conducted to establish how best to design the structure to meet the habitat and flood protection needs of the Refuge. Modeling would also provide the data necessary to determine if the installation of this structure could affect flows in the existing culvert that connects the mitigation channel to Anaheim Bay, as well as to assist in the final design of the water control structure, including the appropriate size and invert elevation of the inlet.

Installation of the new water control structure would require the use of cofferdams, or the implementation of other appropriate actions, to prevent tidal exchange through the construction site while the structure is being installed. The existing culverts would remain in place during this phase of the project to ensure continued tidal exchange within the Bolsa Cell. Once installed, tidal flows through the water control structure could be adjusted to maintain tidal elevations in the Bolsa Cell that would optimize habitat quality for light-footed clapper rails and Belding's savannah sparrows, while remaining low enough to ensure that adjacent structures would not be subject to inundation. This structure would also enable the Refuge Manager to regulate elevations in the Bolsa Cell in the future as needed to respond to the effects of sea level rise.

The proposal to conduct further analysis, including modeling of proposed actions, prior to implementing any projects that could affect the hydrology within the Refuge's coastal wetlands,

would ensure that no significant adverse impacts related to hydrology and flooding would result from the implementation of Alternative B.

Public Use

The continuation of the limited public use program proposed under Alternative B would not result in any significant adverse effects to local hydrology on the Refuge or beyond the Refuge boundary in Anaheim Bay.

5.2.2.6 Effects to Water Quality

Wildlife and Habitat Management

Habitat restoration and enhancement proposals included under Alternative B that could have an effect on water quality include the grading activity associated with the restoration of tidal influence to approximately 36 acres within the Refuge, as well as activities associated with replacing existing culverts, including the culverts in the Bolsa Levee. These actions have the potential to increase erosion and sedimentation into adjacent wetland areas, particularly during storm events. Excess sediment in runoff from a construction site both during and after construction can cause increased turbidity in natural water systems, reducing the amount of sunlight reaching aquatic plants, such as eelgrass, clogging fish gills, and blanketing aquatic habitat and potential spawning areas with silt. Sediment introduced into adjacent waterway can also transport other pollutants such as nutrients, metals, and oils and greases into adjacent wetlands. These effects can be avoided through appropriate construction design and construction activity.

To avoid such water quality impacts, the construction specifications for each individual restoration project would include the requirement to implement appropriate BMPs. These BMPs could include the use of silt fencing, straw wattles, and filter fabric to prevent the introduction of exposed soils into adjacent wetland areas, the installation of cofferdams during construction, proper maintenance and fueling of construction vehicles to avoid spills and tracking of dirt onto public roadways, and appropriate erosion control techniques following construction to minimize the potential for erosion while the desired vegetation becomes established. With the implementation of appropriate BMPs, no adverse effects to water quality within the Refuge or Anaheim Bay would occur as a result of any ground disturbing activities proposed under Alternative B.

The potential for impacts to water quality would be further reduced by the implementation of a Storm Water Pollution Prevention Plan (SWPPP) during construction, as required by the State of California as part of the California NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities. Coverage under this General Permit, which involves electronically filing the Permit Registration Documents (i.e., Notice of Intent, SWPPP, and other compliance related documents required by this General Permit) with the State, would be obtained for all construction projects on the Refuge, including restoration projects, which disturb one or more acres of land surface.

Alternative B also proposes the implementation of a water quality monitoring program to regularly collect data on the basic physical parameters of the waters within the Refuge. Additionally, Refuge staff would participate in other federal, state, and local agency activities related to the improvement of quality of water throughout the watersheds that ultimately empty into Anaheim Bay. Through such a multi-agency partnership, the Refuge would seek to implement measures that would reduce the level of pollutants in the Bolsa Chica and East Garden Grove-Wintersburg channels that could adversely affect habitat quality and trust resources on the Refuge. To the extent that its aims could be achieved, this proposal's effects on water quality would be beneficial.

Pest Management

The effects to water quality of continuing to use Aquamaster and Glyphosate Pro 4 (active ingredient glyphosate), Surflan AS (active ingredient oryzalin), Habitat (active ingredient imazapyr), Altosid Briquets and Altosid Pellets WSP (active ingredient methoprene), VectoBac 12AS and VectoBac G (active ingredient *Bacillus thuringiensis israelensis*), and VectoLex WDG (active ingredient *Bacillus sphaericus*) would be similar to those described under Alternative A. The difference between Alternatives A and B is that under Alternative B, the use of these products would be implemented in accordance with the IPM Plan, presented in Appendix C, and the Mosquito Management Plan, presented in Appendix D. These plans address a number of BMPs that would be implemented to minimize any adverse effects of pesticide application to water quality.

As described in Appendix C, along with the selective use of pesticides, IPM involves the implementation of a number of other strategies for eradicating, controlling, and containing pest species. These strategies include prevention, mechanical and physical methods, cultural methods, biological control methods, and habitat maintenance, enhancement, and restoration. The effects of these non-pesticide IPM strategies (e.g., the physical removal of invasive plants with hand tools, possible use of biological controls to eliminate tamarisk, restoration of native species in disturbed areas) to address pest species on the Refuge would be similar to those effects described elsewhere within this chapter, where they are discussed specifically as habitat management techniques to achieve resource management objectives.

All pesticides considered for use on the Refuge, including any new pesticides that may be applied following the approval of this CCP, are evaluated through the PUP review process using scientific information and analyses that is documented in "Chemical Profiles" of the IPM (Appendix C, Attachment B). These profiles, which are described in detail in Section 7 of the IPM Plan, provide quantitative assessment/screening tools and threshold values to evaluate potential effects to water, soil, and air. The use of specific pesticides on the Refuge is approved when the Chemical Profiles prepared for each active ingredient indicate sufficient scientific evidence that potential impacts to the Refuge's physical environment are likely to be only minor, temporary, or localized in nature. This analysis, which is conducted by the Regional IPM Coordinator, may indicate the need to adjust application timing and/or quantities and/or the need for specific BMPs to protect water quality.

A number of BMPs intended to protect water quality are included in the IPM Plan that would be implemented on the Refuge whenever pesticide application occurs. Some of these BMPs include:

- As a precaution against spilling, spray tanks will not be left unattended during filling.
- Refuge staff will consider the water quality parameters (e.g., pH, hardness) that are important to ensure the greatest efficacy, when specified on the pesticide label.
- All pesticide spills will be addressed immediately using procedures identified in the Refuge's spill respond plan.
- A one-foot no-spray buffer from the water's edge will be used, where applicable, and when it does not detrimentally influence effective control of pest species.
- Refuge staff will use low impact herbicide application techniques (e.g., spot treatment, cut stump, oil basal, Thinvert system applications) rather than broadcast foliar applications (e.g., boom sprayer, other larger tank wand applications), where practical.
- Equipment will be calibrated regularly to ensure that the proper rate of pesticide is applied to the target area or species.

- Spray applications will not be conducted on days with >30% forecast for rain within six hours, except for pesticides that are rapidly rain fast (e.g., glyphosate in 1 hour) to minimize or eliminate potential runoff.

A complete list of the BMPs to be implemented on the Refuge is provided in Section 5.0 of the draft IPM Plan (Appendix C).

In some cases (as described in the Environmental Fate discussion found in Section 7.6 of the draft IPM Plan [Appendix C]), product specific BMPs must be implemented to ensure that impacts to water quality are not significant. For example, to minimize the potential for groundwater quality degradation as a result of leaching and/or surface runoff, a pesticide with a soil half life or aquatic persistence half life of more than 100 days would only be approved for use on the Refuge if one or more of the following BMPs are implemented: 1) limiting application of a particular product to one application per site per year; 2) not using a particular product on coarse-textured soils where the groundwater table is less than 10 feet below the surface and the average annual precipitation is greater than 12 inches; and/or 3) not using a particular product on steep slopes if substantial rainfall is expected within 24 hours or the ground is already saturated. The same BMPs are required if the soil or aquatic dissipation time (DT_{50}) (i.e., the time required for 50 percent of the deposited pesticide to degrade and move from a treated site) for a proposed product is greater than 100 days.

The potential for a pesticide to move to groundwater is another factor that is considered in the PUP approval process. This potential is determined using the Groundwater Ubiquity Score (GUS) (refer Section 7.6 of Appendix C for more information about GUS). Where GUS is greater than 4.0, a PUP will only be approved with additional BMPs implemented specifically to protect water quality. These are the same BMPs described above for soil half life and DT_{50}.

Based on scientific information and analyses documented in the "Chemical Profiles" in the IPM Plan, pesticides allowed for use on refuge lands would be relatively low risk to surface and groundwater quality as a result of low toxicity or short persistence in the environment, and/or the implementation of general and pesticide specific BMPs. The risks to water quality of particular pesticides presented in Table 5-2 is derived from pesticide product labels and the Pesticide Properties Database (*PPDB 2009*) developed by the Agriculture & Environment Research Unit of the University of Hertfordshire http://sitem.herts.ac.uk/aeru/footprint/en/index.htm.

As described above, additional BMPs may be required for certain products proposed for use on the Refuge. The following specific BMPs are identified in the Chemical Profiles for the use of glyphosate and oryzalin:

> Glyphosate: Apply aquatic labeled or surfactant free glyphosate formulations to aquatic habitats and riparian habitats within 25 feet of surface water resources.
>
> Oryzalin: Allow one application at 1.5 pounds of active ingredient per acre per year; maintain a minimum 25-foot buffer zone between all upland treatment site(s) and the high water mark of the nearest surface water resource(s); and avoid the application of oryzalin to sites that are upslope of any surface water resources when the slope gradient is greater than 17 percent.

No specific BMPs are required for the use of products containing the active ingredient imazapyr.

Table 5-2
Environmental Fate of Herbicides Used on the Refuge
(Factors Specific to Water Quality)

Active Ingredient	Product Name(s)	Formulation and application details	Solubility in Water at 20°C	Soil Degradation	Aquatic Degradation	GUS Leaching Potential
Glyphosate	Glyphosate Pro 4 (includes a surfactant)	Mix with water and spray or apply with a wiper or sponge bar	High (emulsifies)	Non-persistent	<100 days	Low leachability
Glyphosate	Aquamaster	Mix with water and a nonionic surfactant, and spray or apply with a wiper or sponge bar	High (completely miscible)	Non-persistent	<100 days	Low leachability
Imazapyr	Habitat	Mix with water and a surfactant, and spray	High (miscible)	Non-persistent	<100 days	Moderate leachability (GUS < 2)
Oryzalin	Surflan AS	Usually mix with water and spray	Low (miscible)	Moderately persistent	<100 days	Low leachability

The Mosquito Management Plan (Appendix D) addresses control of mosquitoes on the Refuge using a phased, integrated pest management approach, as described in Chapter 3. Under this alternative, the mosquito control products currently used on the Refuge, as presented in the discussion for Alternative A, would also be used under Alternative B. Therefore, the potential effects to water quality described under Alternative A would also apply to Alternative B.

Also addressed under Alternative B is the OCVCD's request to use several new products on the Refuge for the control of mosquitoes. Before these or any new pesticide proposed for mosquito control can be used on the Refuge, they must first be approved through the PUP review process and specifically permitted for use in the Refuge Special Use Permit. The products proposed by the OCVCD for use on the Refuge include: Natular™, a larvicide with the active ingredient spinosad; Agnique®, a larvicide and pupacide made from renewable plant oils; and Anvil™ in the forms AquaAnvil™ and Anvil 10+10 ULV, both used in adult mosquito control.
With respect to water quality, Natular and Agnique are generally non-persistent in soil or water and are not expected to leach into groundwater. No water quality standards or criteria have been established for spinosad, the active ingredient in Natular, but it is classified as a "Minimum Risk Pesticide" by the USEPA. Agnique is considered "practically nontoxic" by the USEPA. In accordance with the Mosquito Management Plan, Agnique or other nonmolecular biodegradable film products would be considered for use on the Refuge only if the numbers of mosquito pupae present on the Refuge are considered an immediate threat to human health and thresholds developed by OCVCD (*2010*) have been exceeded.

Anvil products include the active ingredient sumithrin, a compound made up of phenothrin and piperonyl butoxide. Phenothrin is not very soluble in water but is soluble in organic solvents. Based on the chemical characteristics of Anvil, it is likely to have a greater affinity for organic material in soils and sediments than water. The reported half life in water is relatively short, approximately seven days, and the soil dissipation half life is between eight and twelve days. Sumithrin has low leachability. AquaAnvil, because it is water-based, has a much lower potential for introducing oil derived materials into wetlands than Anvil 10 + 10 ULV, which is oil-based.

The USEPA (*2008b*) describes the environmental fate and transport of phenothrin as follows:

> *Phenothrin's moderate persistence in surface soils, its relatively high affinity for binding to soils, and low solubility indicate a high potential for the chemical to enter surface waters during runoff events that contribute to soil erosion during the weeks following an application event. Phenothrin could also reach surface waters as the result of spray drift following an application with ULV [ultra-low volume] equipment. Its low leaching potential, however, also means that it is likely to remain immobile once it binds to soil sediments. Furthermore, it is unlikely to seep into groundwater supplies and cause contamination. Even though phenothrin is likely to undergo photolysis in water, its high affinity for binding to particulate matter make photolysis less likely to happen, except during the brief period in which the chemical is suspended in water without binding to sediment. The photolysis of phenothrin is expected to occur in shallow waters or in the upper levels of the water column where sunlight is able to penetrate. Phenothrin's large binding affinity for sediment or suspended solids in the water column also indicate a high potential for continued persistence in aquatic systems . . . Leaching does not appear to be a significant route of dissipation for phenothrin . . . Unbound phenothrin is unlikely to remain free in the water column for any significant period of time. If multiple applications are made, however, phenothrin bound to sediment and free in the water column could accumulate significantly in aquatic ecosystems. Acute and chronic exposure risks from phenothrin exist to organisms living in the water column and in the benthic sediments lining water bodies.*

Piperonyl butoxide, the other active ingredient in Anvil products, is a synergist that is typically combined with sumithrin. It enhances the effectiveness of sumithrin by inhibiting the metabolism of the pyrethroid by mosquitoes. It is not expected to adsorb to sediment, therefore, it would be expected to leach from soil and be released in water. It may photodegrade in surface waters, but its degradation in the aquatic environment is currently unknown.

No other adulticides, including the organophosphates malathion and naled, are currently proposed for use on the Refuge.

To minimize or avoid adverse effects to water quality related to all forms of mosquito control, the following BMPs are required to be implemented in accordance with the Mosquito Management Plan (Appendix D):

- Where mosquito control is necessary, use the most effective means that pose the lowest risk to abiotic and biotic resources;
- Apply pesticides only in specific, discrete areas where monitoring data justify its use.
- Use of drift retardants (thickeners designed to minimize the formation of droplets smaller than 150 microns), which have also been evaluated through the PUP review process, to reduce aerial drift of pesticides;
- Employ wind speed restrictions on spraying;
- Any application of adulticides should occur at an ultra-low volume (lowest possible dilution rate that is still effective);
- All adulticide applications should be conducted from the roads that extend along the northern, eastern, and western perimeter of the Refuge and only when meteorological conditions are stable and favorable with a consistent wind greater than three miles per hour from the south or southwest; and
- Any application of adulticide should be limited in terms of number of applications per season and shall only occur when a public health emergency has been declared, and the use of an adulticide shall be coupled with larvicide treatment to prevent a second adult emergence.

Public Use

The potential effects to water quality from implementing the current public use program, as proposed under Alternative B, would be same as those discussed under Alternative A.

5.2.2.7 Effects from Climate Change/Sea Level Rise

Wildlife and Habitat Management

The effects of climate change and sea level rise on Refuge resources and facilities would be the same for Alternative B as those described under Alternative A, above. However, unlike Alternative A, Alternative B includes strategies intended to assist Refuge staff in identifying and addressing changes related to sea level rise. These strategies include the development and implementation of a plan to annually track changes in tidal elevations within various areas of the refuge and establish benchmarks, based on the duration of inundation, high tide levels, and other appropriate factors, for implementing actions to address these changes.

Additionally, by 2015 a study will be completed that will analyze various measures that could be implemented on the Refuge to reduce the effect of sea level rise on sensitive coastal habitats. Such measures could include retrofitting existing water control structures to manipulate tidal flows entering the previously restored portions of the Refuge, including Forrester Pond, Case Road Pond, and 7th Street Pond; installing new water control structures elsewhere on the Refuge for the same purpose; and raising the elevations of the existing marsh plain by spraying or otherwise applying appropriate sediment over the existing marsh vegetation. The implementation of these types of measures is expected to adequately address the effects of sea level rise over the 15-year life of this CCP. However, despite these actions, the SLAMM results indicate that sea level rise over the next 25 to 100 years are likely to have a profound impact on the trust resources protected within the Seal Beach NWR. Therefore, reevaluation of the goals, objectives, and strategies addressed in this the CCP may be necessary in the future to determine if and how additional strategies for addressing the effects of sea level rise on these coastal resources should be implemented.

Public Use

Alternative B does not propose any changes to the existing public use program implemented on the Refuge; therefore, the effects of sea level rise on public uses would be the same for Alternative B as were described for Alternative A.

5.2.2.8 Effects to Air Quality

Wildlife and Habitat Management

Each of the management activities conducted under Alternative A would also occur under Alternative B. As described in Section 5.2.1.8 above, none of these activities would result in adverse effects to air quality. The additional management activities included within Alternative B that relate to habitat restoration, culvert replacement, and concrete debris removal would result in temporary, localized adverse impacts to air quality related to fugitive dust and tailpipe emissions generated by construction equipment (e.g., land excavators, motor graders, dump trucks, excavator with a hydraulic hammer). The various activities would take place over a period of one to two months and are not expected to generate emissions in excess of current air quality standards. To ensure that all emissions are minimized to the maximum extent practicable, the following measures would be included in the construction specifications for all proposed restoration and enhancement projects implemented on the Refuge:

- Measures shall be implemented to prevent visible dust emissions from leaving the project site boundary, including, but not limited to, watering prior to and during any earth movement; watering exposed soil three times per day, as applicable; installing wind fencing; covering excavated materials to prevent erosion; and stopping work during high wind conditions.

- The load of all haul vehicles shall be covered to reduce fugitive dust generated during the transport of materials and any stock piled material shall be covered to reduce the production of dust.

- Construction equipment and vehicles shall not track dirt and dust onto public roads and all equipment and tires shall be washed/swept prior to leaving the project site.

- All equipment used on the site shall meet SCAQMD standards.

The additional activities proposed under Alternative B would not generate any additional vehicle trips following project completion, therefore, these proposal would not generate any long-term air emissions beyond those already described for Alternative A. Through the implementation of the measures described above, short-term emissions generated as a result of the proposed restoration would not contribute significantly to a cumulative increase in short-term emissions.

Compliance with SCAQMD rules and regulations, as well as the implementation of the air quality measures described above, would ensure that air emission from the implementation of this alternative would not contribute significantly to a cumulative increase in emissions. Finally, the proposals in this alternative are not expected to exceed SCAQMD thresholds and Federal "de minimis" levels, however general conformity analysis may be implemented in the future when more detailed information about the restoration proposal is available.

Pest Management

Several pesticides are used on the Refuge including herbicides to control invasive plants and insecticides, applied by OCVCD, to control mosquitoes. Pesticides in general can volatilize from soil and plant surfaces and move from the treated area into the atmosphere. The potential for a pesticide to volatilize is determined by the pesticide's vapor pressure. Surflan AS is considered non volatile, while Aquamaster, Glyphosate Pro 4, and Habitat are volatile. Because all of these products are used at such low volumes on the Refuge, even the volatile products quickly become diluted in the atmosphere, minimizing the effect on local air quality. The potential for adverse air quality impacts as a result of pesticide use is further reduced through compliance with all federal, state, and local pesticide use laws and regulations, as well as Departmental, Service, and NWRS pesticide-related policies. This includes compliance with the Federal Insecticide, Fungicide and Rodenticide Act of 1996 (FIFRA), which requires all pesticides to be applied at the rates and with the application equipment specified on the pesticide label. The IPM Plan (Appendix C) includes a number of BMPs that would be implemented in association with pesticide use of the Refuge to further minimize potential effects to air quality. Some of these BMPs include:

- Refuge staff will use low impact herbicide application techniques (e.g., spot treatment, cut stump, oil basal, Thinvert system applications) rather than broadcast foliar applications (e.g., boom sprayer, other larger tank wand applications), where practical;
- Refuge staff will use low volume rather than high volume foliar applications when the low impact methods described above are not feasible or practical, to maximize herbicide effectiveness and ensure correct and uniform application rates;

- Applicators will use and adjust spray equipment to apply the coarsest droplet size spectrum with optimal coverage of the target species while reducing drift;
- Applicators will use the largest droplet size that results in uniform coverage;
- Applicators will use drift reduction technologies such as low-drift nozzles, where possible;
- Where possible, spraying will occur during low (average<7mph and preferably 3 to 5 mph) and consistent direction wind conditions with moderate temperatures (typically <85 °F);
- Where possible, applicators will avoid spraying during inversion conditions (often associated with calm and very low wind conditions) that can cause large-scale herbicide drift to non-target areas;
- Equipment will be calibrated regularly to ensure that the proper rate of pesticide is applied to the target area or species;
- Spray applications will be made at the lowest height for uniform coverage of target pests to minimize or eliminate potential drift; and
- If windy conditions frequently occur during afternoons, spraying (especially boom treatments) will typically be conducted during early morning hours.

A complete list of the BMPs to be implemented on the Refuge is provided in Section 5.0 of the IPM Plan (Appendix C).

In some cases (as described in the Environmental Fate discussion found in Section 7.6 of the IPM Plan [Appendix C]), product specific BMPs would be implemented to ensure that impacts to air quality are not significant. For example, pesticides with a high potential to volatilize (evaporate) from soil and plant surfaces and move off-target into the atmosphere would only be approved for use on the Refuge if additional BMPs are implemented specifically to minimize drift and protect air quality. The BMPs required under these circumstances include:

- Do not treat when wind velocities are less than two or greater than ten miles per hour with existing or potential inversion conditions;
- Apply the largest-diameter droplets possible for spray treatments;
- Avoid spraying when air temperatures exceed 85°F;
- Use the lowest spray height possible above target canopy; and
- Where identified on the pesticide label, incorporate the pesticide into the soil as soon as possible during or after application.

The implementation of the various BMPs described in the preceding paragraphs would reduce the potential for localized and any potential regional air quality impacts related to herbicide use to below a level of significance.

Implementation of the Mosquito Management Plan presented in Appendix D would result in little, if any, change in the number of vehicle miles traveled by OCVCD to implement mosquito monitoring and control on the Refuge. With respect to pesticide use, the Mosquito Management Plan includes BMPs that when implemented would reduce localized impacts to air quality from volatile pesticides such as Altosid and Anvil. These BMPs include:

- Where possible, applicators will avoid spraying during inversion conditions (often associated with calm and very low wind conditions) that can cause large-scale herbicide drift to non-target areas;

- Equipment will be calibrated regularly to ensure that the proper rate of pesticide is applied to the target area or species;
- When spraying large areas, use drift retardants to reduce aerial drift of pesticides;
- Spray applications will be made at the lowest height for uniform coverage of target pests to minimize or eliminate potential drift; and
- If windy conditions frequently occur during afternoons, spraying (especially boom treatments) will typically be conducted during early morning hours.

Public Use

The continuation of the limited public use program as currently conducted on the Refuge would not result in any significant adverse effects to air quality. Vehicular emissions from the travel of visitors to the Refuge for monthly tours are negligible in the context of the wider airshed of the SCAQMD.

5.2.2.9 Effects Related to Greenhouse Gas Emissions

Wildlife and Habitat Management

In addition to the management activities described for Alternative A, Alternative B also proposes the restoration and enhancement of approximately 36 acres of tidally influenced habitat, replace the culverts in the Bolsa Cell, and remove concrete debris from the marsh. These additional activities will result in a temporary increase in GHG emissions over those anticipated under Alternative A, however, the proposed construction activities will occur over relatively short period of time. The overall GHG emissions generated by two or three construction vehicles operating over a one to two month period would be relatively low compared to the other activities occurring within the SCAQMD. Therefore, the GHG emissions anticipated to result from the implementation of this alternative are not expected to represent a significant direct or indirect impact on the environment.

To further reduce the total GHG emissions generated from the operation and maintenance of the Refuge, as vehicles are replaced, new vehicles will be selected that have better fuel economy. In addition, where ever possible, tasks requiring off-Refuge travel will be combined to reduce the total number of miles driven by Refuge staff. Office equipment, including light fixtures, will be evaluated and replaced as necessary with "Energy Star" qualified products. The power management features on all computers and monitors will be activated, laptop power cords will be unplugged when not in use, and all equipment and lights will be turned off at the end of the day.

Public Use

The effects of the Refuge's existing public use program on GHG emissions would be the same under Alternative B as were described in Section 5.2.1.9 for Alternative A.

5.2.2.10 Effects Related to Contaminants

Wildlife and Habitat Management

Under Alternative B, several areas on the Refuge are proposed as sites for future restoration. Of these restoration sites, the area southeast of the 7th Street Pond was formerly used by the Navy as an explosives burning ground. Groundwater sampling at this site in 2003 and 2004 indicated that no contaminants concerns were present at the site and the site was considered closed. Nevertheless, coordination with the Navy during the development of specific restoration plans for this site would be conducted to ensure that no constituents of concern to Refuge trust resources or water quality are present at the site. In addition, the monitoring wells that were installed at this site to facilitate monitoring of contaminants levels would have to be removed prior to restoration.

No other areas proposed for restoration have been identified as including any constituents of concern. However, prior to restoration around the existing drop tower, this area would be evaluated to ensure that no buried ordinance is present in the vicinity of the proposed restoration.

Public Use

No contaminants are known or expected to be present in areas used by the public as part of the public use programs currently conducted on the Refuge.

5.2.3 Alternative C (Proposed Action) – Optimize Upland/Wetland Restoration, Improve Opportunities for Wildlife Observation

All of the management activities described in Alternative A would also be implemented under Alternative C. In addition, this alternative includes restoration and enhancement proposals for the same areas proposed under Alternative B; however, under Alternative C these areas would be restored to a combination of tidally influenced wetlands and native upland areas. Other activities proposed under Alternative C include developing a management plan for tiger beetles, establishing salt marsh bird's-beak on the Refuge, removing the existing drop tower near the 7th Street Pond, and implementing actions in a portion of the marsh to improve conditions to support cordgrass-dominated salt marsh habitat. Finally, this alternative proposes to expand the opportunities available on the Refuge for wildlife observation.

5.2.3.1 Effects to Topography/Visual Quality

Wildlife and Habitat Management

The same areas proposed for habitat restoration in Alternative B (approximately 36 acres) would be restored under Alternative C, but the habitat proposals for these areas would provide a greater mix of upland and wetland/upland transitional habitat than is proposed in Alternative B. Areas proposed for upland habitat would experience little or no changes in elevation, while tidal restoration sites would be excavated to achieve elevations that would support the desired tidal wetland habitat (i.e., low marsh, mid marsh, high marsh, upland/wetland transition). The overall extent of change to the existing landform would be less under Alternative C than that required under Alternative B, although the effects to the existing topographic character of the Refuge would be minimal under either alternative.

Under Alternative C, spraying of clean sediment of appropriate grain size and nutrient content onto a portion of the marsh to improve the quality of the cordgrass would be evaluated and potentially implemented. Under this proposal, enough sediment would be distributed over the existing vegetation to provide for a slight increase in the elevation of the marsh plain, while still enabling the vegetation to grow up through the added sediment. The increased elevation of the marsh plain would not however be discernible to the casual observer; therefore, no adverse effects related to topography would occur.

The proposal to replace existing culverts and remove the drop tower would not result in any adverse effects related to topography.

As in Alternative B, under Alternative C, while grading activities are underway during the restoration of habitats, there would be temporary, minor adverse effects to visual quality. However, once grading has concluded and the sites have had the chance to be restored to native salt marsh and transitional habitats, visual quality would be improved over the present condition. Thus, Alternative C would also have a long-term, beneficial impact on visual resources at the

Refuge. Removal of concrete and debris from existing marsh areas and removal of the drop tower would augment these beneficial visual impacts.

Public Use

Alternative C would expand opportunities for environmental education, interpretation, wildlife observation, and wildlife photography by increasing the number of guided tours and constructing an elevated wildlife observation deck. These proposals would have no effect on the topographic character of the Refuge. Because the elevated observation deck proposed for construction under this alternative would be constructed in the general vicinity of other existing structures including the Refuge headquarters and various Navy buildings, it would not fundamentally alter the current visual character of the area. Therefore, the public use proposals included under this alternative would not adversely affect the character or visual quality of the area.

5.2.3.2 Effects to Geology/Soils

Wildlife and Habitat Management

Each of the management activities conducted under Alternative A would also occur under Alternative C. None of these activities would trigger or accelerate substantial slope instability, subsidence, ground failure, or erosion, thus affecting onsite facilities or adjacent facilities, such as roadway embankments and bridge abutments and pilings. Alternative C proposes to expand existing management activities to include habitat restoration, culvert replacement, concrete debris removal, improvements to cordgrass habitat, and removal of the drop tower. Restoration activities could temporarily expose soil to wind and water erosion if BMPs are not implemented during construction. To avoid such impacts, all restoration construction specifications would include the requirement to implement appropriate BMPs for erosion and sediment control during construction to minimize the potential for water and wind erosion at the project site. In addition, all slopes associated with future restoration would have a slope gradient of 4:1 or flatter to avoid the potential for erosion in the future. The restoration of portions of the Refuge's upland areas would have no effect on the site's current susceptibility to geological hazards, such as liquefaction, settlement, ground rupture, or lateral spreading.

To avoid erosion and soil loss during the installation of a new water control structure in the levee to the west of the Bolsa channel, BMPs such as the use of silt fencing, cofferdams, straw wattles, and filter fabric to protect exposed soil would be implemented during project construction. The slopes adjacent to the structure would be protected from erosion through the use of rip rap or native vegetation as deemed appropriate during final design.

The implementation of appropriate BMPs during habitat restoration would reduce the potential for impacts to soil erosion to below a level of significance. Additionally, the restoration proposals included in Alternative C would not trigger or accelerate substantial slope instability, subsidence, ground failure, or erosion that could adversely affect onsite facilities or adjacent facilities, such as roadway embankments and bridge abutments and pilings.

Public Use

Alternative C would expand opportunities for environmental education, interpretation and wildlife observation and wildlife photography by increasing the number of guided tours and constructing an elevated wildlife observation deck. These proposals would have no effects on the Refuge's geology or soils and the proposed observation deck would not be susceptible to geological hazards, such as liquefaction, settlement, ground rupture, or lateral spreading.

5.2.3.3 Effects to Mineral Resources

As described under Alternative B, adding anti-perching features to the tops of the existing power poles used by the ongoing oil extraction operations at Oil Island would not adversely affect the ability of the operator to continue extract oil from beneath the site. Additionally, none of the expanded public use proposals included under Alternative C would affect current oil extraction operations. Therefore, no adverse effects relate to mineral resources are anticipated under this Alternative.

5.2.3.4 Effects to Agricultural Resources

Wildlife and Habitat Management

The effects to adjacent agricultural resources of implementing the wildlife and habitat management actions proposed under Alternative C would be the same as those described under Alternative B.

Public Use

Expanding public use opportunities on the Refuge, as proposed under this alternative, would have no effects on the adjacent farming activities on NWSSB.

5.2.3.5 Effects to Hydrology

Wildlife and Habitat Management

The effects to hydrology under Alternative C would be essentially the same as those described for Alternative B. Therefore, no adverse effects related to hydrology are expected from any of the wildlife and habitat management activities proposed under Alternative C. For additional details, refer to Section 5.2.2.5 above.

Public Use

Expanding public use opportunities on the Refuge, as proposed under Alternative C, would not result in adverse effects to hydrology on the Refuge or in Anaheim Bay.

5.2.3.6 Effects to Water Quality

Wildlife and Habitat Management

Proposals under Alternative C that could have an effect on water quality within Anaheim Bay include grading activity associated with the restoration of approximately 36 acres within the Refuge, as well as activities associated with replacing existing culverts. As described under Alternative B (Section 5.2.2.6), to avoid water quality impacts as a result of construction and restoration projects, the construction specifications for each individual project would include the requirement to implement appropriate BMPs to prevent the introduction of exposed soils into adjacent wetland areas. In addition, these projects would be required to implement the actions included in the Storm Water Pollution Prevention Plan prepared for the project prior to construction. With the implementation of these measures, no adverse effects to water quality within the Refuge or Anaheim Bay would be anticipated from the implementation of the wildlife and habitat management actions associated with Alternative C. The implementation of a water quality monitoring program, as described for Alternative B, would also be implemented under Alternative C.

Pest Management

The analysis of potential effects to water quality from the implementation of the IPM Plan and Mosquito Management Plan under Alternative C would be generally the same as those described under Alternative B. The effects, if any, to water quality as a result of the use of Natular on the Refuge would be avoided because the use of this product is not proposed under Alternative C.

Public Use

Expanding the public use program at Seal Beach NWR would not result in any significant adverse effects to water quality on the Refuge or in Anaheim Bay.

5.2.3.7 Effects from Climate Change/Sea Level Rise

Wildlife and Habitat Management

The effects of climate change and sea level rise on Refuge resources and facilities would be the same for Alternative C as those described under Alternative A, above. However, Alternative C also includes the strategies intended to assist Refuge staff in identifying and addressing changes related to sea level rise, as described in Alternative B, as well as an additional strategy for attempting to replace intertidal habitats anticipated to be converted to subtidal habitat as a result of sea level rise. The implementation of these types of measures is expected to adequately address the effects of sea level rise over the 15-year life of this CCP. However, despite these actions, the SLAMM results indicate that sea level rise over the next 25 to 100 years are likely to have a profound impact on the trust resources protected within the Seal Beach NWR. Therefore, reevaluation of the goals, objectives, and strategies addressed in this the CCP may be necessary in the future to determine if and how additional strategies for addressing the effects of sea level rise on these coastal resources should be implemented.

Public Use

Of the proposals included in Alternative C to expand opportunities for public use, the proposal to construct an elevated observation deck could be subject to impacts related to sea level rise at some point in the future. In order to avoid impacts related to sea level rise, the SLAMM results will be taken into consideration in selecting the site for the proposed elevated observation deck.

5.2.3.8 Effects to Air Quality

Wildlife and Habitat Management

Each of the management activities conducted under Alternative A would also occur under Alternative C. As described in Section 5.2.1.8 above, none of these activities would result in adverse effects to air quality. The additional management activities included within Alternative C that relate to habitat restoration, culvert replacement, concrete debris removal, removal of the drop tower, and improvements to support cordgrass habitat in the marsh would result in temporary, localized adverse impacts to air quality related to fugitive dust and tailpipe emissions generated by construction equipment (e.g., land excavators, motor graders, dump trucks, excavator with a hydraulic hammer, generators). The various activities would take place over a period of two to three months and are not expected to generate emissions in excess of current air quality standards. To ensure that all emissions are minimized to the maximum extent practicable, the following measures would be included in the construction specifications for all construction related projects implemented on the Refuge:

- Measures shall be implemented to prevent visible dust emissions from leaving the project site boundary, including, but not limited to, watering prior to and during any earth movement; watering exposed soil three times per day, as applicable; installing wind fencing; covering excavated materials to prevent erosion; and stopping work during high wind conditions.

- The load of all haul vehicles shall be covered to reduce fugitive dust generated during the transport of materials and any stock piled material shall be covered to reduce the production of dust.

- Construction equipment and vehicles shall not track dirt and dust onto public roads and all equipment and tires shall be washed/swept prior to leaving the project site.

- All equipment used on the site shall meet SCAQMD standards.

The construction activities proposed under Alternative C would not generate any long-term vehicle trips; therefore, no long-term impacts to air quality are anticipated. Through the implementation of the measures described above, short-term emissions generated as a result of the proposed management activities would not contribute significantly to direct or cumulative increases in short-term emissions.

Compliance with SCAQMD rules and regulations, as well as the implementation of the air quality measures described above, would ensure that air emission from the implementation of this alternative would not result in the further degradation of air quality within the SCAQMD. Finally, the proposals in this alternative are not expected to exceed SCAQMD thresholds and Federal de minimis levels, however general conformity analysis may be implemented in the future when more detailed information about the restoration proposal is available.

Pest Management

The analysis of potential effects to air quality from the implementation of the IPM and Mosquito Management plans would be the same under this alternative as described previously for Alternative B.

Public Use

Expanding the public use program on the Refuge would result in minor increases in annual visitation to the Refuge, representing an increase in vehicle trips generated. This increase is not however expected to be significant as access to the Refuge is limited by the security needs of the Navy. Vehicular emissions from the travel of visitors to the Refuge under this alternative would be negligible in the context of the wider airshed of the SCAQMD.

5.2.3.9 Effects Related to Greenhouse Gas Emissions

Wildlife and Habitat Management

The GHG emissions generated as a result of implementing the management activities included under Alternative C would be slightly higher than those anticipated under Alternative B. The increase would be attributed to the temporary use of generators to facilitate hydraulic spraying of marsh mud onto existing cordgrass habitat. Some of these emissions would be offset by a slight reduction in construction emission, as upland restoration would require less grading activity than would the extent of salt marsh restoration proposed under Alternative B.

Although this alternative would result in a slight increase in the generation of temporary GHG emissions, the emissions would occur over relatively short period of time. Therefore, the GHG emissions anticipated to result from the implementation of this alternative are not expected to represent a significant direct or indirect impact on the environment.

The measures described for reducing GHG emissions associated with Refuge management, as described under Alternative B, would also be implemented under this alternative.

Public Use

Although the public use program would be expanded under this alternative, the increase in visitation that would result would not of a sufficient magnitude to generate significant volumes of

GHG emissions. Therefore, this alternative would not represent a significant contribution, either directly or cumulatively, to the GHG emissions generated in the SCAQMD air basin.

5.2.3.10 Effects Related to Contaminants

Wildlife and Habitat Management

The areas proposed for restoration under Alternative C are the same areas proposed for restoration under Alternative B, only the habitat types would differ, therefore, the potential for impacts related to contaminants would be the same as those described under Alternative B.

Public Use

No contaminants are known or expected to be present in areas were expanded public use programs as proposed under Alternative C, would be conducted.

5.3 Effects to Habitat and Vegetation Resources

The effects to the habitats and vegetation supported on the Seal Beach NWR as a result of implementing the three alternatives are described below. Potential impacts to these resources are characterized by evaluating direct, indirect, and cumulative effects. Direct impacts would involve the removal of vegetation as a result of ground-disturbing actions, while indirect impacts would involve changes to habitat or vegetation that are incidental to the implementation of an action. Cumulative impacts to habitat and vegetation resources, described in Section 5.9.2.2, would result when the incremental impact of an action is added to other, closely related past, present, or reasonably foreseeable future actions.

An adverse effect to habitat or vegetation resources would be considered significant if:

- A substantial portion of native habitat would be removed or otherwise modified to accommodate a proposed action.
- An action would result in the direct mortality or habitat loss, lowered reproductive success, or habitat fragmentation of a sensitive or narrow endemic plant species.

A significant cumulative effect would occur if the loss or modification of native habitat or a sensitive or narrow endemic plant species as a result of the proposed action is minor but, when considered in light of other similar losses or gains within the region, would be considerable.

The potential effects to habitats, including subtidal, coastal salt marsh, transitional and upland habitats, and to native vegetation are described below for each of the three alternatives.

5.3.1 Alternative A – No Action

Wildlife and Habitat Management

The area of each major habitat type on the Refuge would remain generally unchanged under Alternative A, as would the relative quality of each habitat type. That is, unrestored upland areas dominated by ruderal or invasive plants would continue in this sub-optimal condition. The muted tidal regimes of the Refuge's four tidal basins would continue to support large areas of continually submerged, shallow subtidal habitat. Tidal waters from Anaheim Bay would continue to enter and exit the restored ponds via constructed channels and culverts that pass under the surrounding roadways. Eelgrass beds would likely continue to be found in various locations throughout the Refuge's subtidal habitat, including some of the subtidal channels and all of the mitigation ponds.

Coastal salt marsh, covering approximately 565 acres within the Refuge, would continue to be the dominant habitat type on the Refuge and intertidal channels and tidal mudflats would not be altered. No actions would be implemented to address the effects of limited sources of freshwater input and higher tidal elevations and/or subsidence on the overall quality of the cordgrass-dominated habitat on the Refuge.

The Refuge's upland habitat, most of which was historically wetland habitat that was filled during the last century to accommodate development, would be retained under Alternative A. Hog Island, which is the only area within the Refuge that historically supported native upland vegetation, would also remain unchanged under Alternative A.

Management activities proposed under Alternative A that could have an effect on the existing habitat and vegetation on the Refuge include:

- Light-footed clapper rail monitoring to record nesting activity and estimate overall population size;
- Conducting monthly bird surveys;
- Inspecting, maintaining, replacing and/or installing clapper rail nesting platforms in salt marsh habitat;
- Conducting invasive plant control in upland and upland transition areas;
- Removing trash and debris from upland and upland transition areas, as well as along the edges of the marsh;
- Inspecting, cleaning, and/or replacing culverts on the Refuge that convey tidal waters into various portions of the Refuge; and
- Implementing predator management, including conducting periodic night surveys to identify potential predators.

Monitoring of light-footed clapper rails is generally conducted from the edges of the marsh and from non-motorized boats traveling through the marsh. Actions related to the nesting platforms are also conducted using boats. Monitoring teams and volunteers are trained to understand the importance of protecting the sensitive marsh habitat and every effort is taken to avoid the trampling of vegetation during these activities. As a result, adverse effects to native habitat related to clapper rail management are minimal and do not represent a significant adverse impact on the environment.

The effects to habitat and vegetation as a result of conducting monthly bird surveys are similar to those described for clapper rail monitoring. Therefore, this activity would not result in any significant adverse impacts to the environment.

Removal of trash and other debris from the Refuge could result in temporary impacts related to trampling of vegetation; however, the majority of trash removal occurs in areas dominated by nonnative vegetation or at the edges of the marsh. Any trampling of marsh vegetation that may occur would be minor and would be offset by the benefits of removing trash and debris from the marsh.

Monitoring, cleaning, and/or replacing of the various culverts on the Refuge could result in some temporary impacts to marsh habitat, but these effects would be minimal and the benefits of maintaining adequate tidal circulation within the various wetland areas on the Refuge would offset any temporary impacts to existing habitat. If permanent impacts to native habitat would occur as a result of the activities associated with culvert replacement, mitigation in the form of habitat

restoration/creation using accepted replacement ratios for the affected native habitat would be provided.

Predator management is generally conducted from the edges of the marsh and in the vicinity of the least tern nesting area, therefore, the potential for trampling of sensitive habitat and vegetation is minimal.

Based on the information provided above, the wildlife and habitat management actions associated with Alternative A would not result in significant adverse impacts to Refuge habitats or sensitive vegetation. Rather, the effects to these habitats of implementing this alternative would tend to be neutral or in some cases beneficial.

Pest Management

Under Alternative A, invasive plant removal involves both mechanical and chemical control methods, with control focused on invasive, weedy plant species present in the Refuge's upland and upland transition areas. The primarily locations on the Refuge where this control occurs include: the upland area north of the Case Street Pond; the area southeast of the 7th Street Pond; NASA Island; and Hog Island. Other focus areas include the shoulders of Bolsa Avenue, Forrestal Lane, and the east side of Kitts Highway. The use of herbicides to control invasive, nonnative plants, could adversely impact non-target plants due to pesticide drift, if appropriate application techniques are not employed. However, the potential for adverse effects is considered minimal because of the small quantities of herbicide used and the precautionary measures taken during application, including applying all herbicides in accordance with label requirements. Hand weeding, rather than spraying, would be conducted in sensitive habitat areas, such as areas dominated by native salt marsh habitat. If spraying is proposed in proximity to sensitive habitat areas, the area to be sprayed would first be surveyed for sensitive species and areas to be avoided during spraying would be flagged or otherwise delineated to ensure avoidance of these areas. Hand weeding and limited herbicide spraying would also provide minor benefits to habitat areas by providing opportunities for increased native plant cover.

Activities associated with mosquito management on the Refuge could result in impacts to vegetation related to trampling. This is of particular concern in areas that support salt marsh habitat. To minimize such impacts, access into the marsh by mechanized vehicles is prohibited and mosquito monitoring and control is limited to six specific areas on the Refuge. These areas are located around the perimeter of the salt marsh complex, and can only be accessed via foot traffic. If a significant mosquito problem is identified elsewhere on the Refuge, access into the affected area requires prior approval by the Refuge Manager and OCVCD staff must be accompanied into the area by authorized Service personnel.

The application of VectoBac 12AS, VectoBac G, VectoLex WDG and Altosid to control mosquito production on the Refuge is not likely to adversely affect vegetation directly because these pesticides are not known to harm plants. Although reductions in certain invertebrate populations as a result of repeated pesticide applications may have the potential to impact specific invertebrate-plant interactions (e.g., pollination) on the Refuge, because only a limited portion of the Refuge is subject to mosquito control, the adverse effects to vegetation and habitat quality of such an impact would be minimal.

Public Use

Activities associated with the existing public use program on the Refuge are limited to existing roadways, trails, and unvegetated areas to avoid impacts to sensitive habitat and vegetation. Therefore, the continuation of these programs would not adversely affect any Refuge habitats.

Another use that occasionally occurs on the Refuge is scientific research. Scientific research activities are encouraged on the Refuge provided the activities are consistent with Refuge purposes and the mission of the NWRS. To ensure that activities related to scientific research do not result in adverse effects to Refuge resources, each researcher must obtain a Refuge Special Use Permit from the Refuge Manager. The Special Use Permit includes various conditions related to access, seasonally restrictions, and research methods that the researcher must agree to abide by in order to avoid impacts to sensitive resources.

5.3.2 Alternative B – Maximize Salt Marsh Restoration, Continue Current Public Uses

Wildlife and Habitat Management

The primary difference between Alternative A and Alternative B with regard to habitats is that Alternative B includes restoration and enhancement proposals that would replace upland areas supporting nonnative vegetation with coastal salt marsh and wetland/upland transitional habitat. Under Alternative B, the area of subtidal and intertidal habitats would remain unchanged, while much of the disturbed upland habitat would be restored to tidally influenced habitat or native wetland/upland transition habitat. The existing upland sites proposed for restoration are all areas that were originally wetlands or transitional habitat, but were filled prior to the establishment of the Refuge to support upland uses.

The proposed salt marsh and wetland/upland transition restoration sites include 21 acres of land located to the north of Case Road Pond, 0.6 acre on the eastern-most island in the Case Road Pond, 9.4 acres to the southeast of 7th Street Pond, and 5.5 acres located along the western edge of 7th Street Pond and around the existing drop tower at the southern end of 7th Street. The remaining areas of nonnative upland habitat located along roadways, pathways, and upland edges of existing wetland areas would over time be planted with appropriate native upland species. Such plantings would generally occur following invasive plant removal to avoid reinvasion of the treated area by nonnative plants and to minimize the potential for erosion of exposed soils into adjacent wetland areas. To ensure that no significant short- or long-term impacts to existing native habitat would occur as a result of the restoration and enhancement proposals included in Alternative B, native habitat in the immediate vicinity of a restoration or enhancement project would be protected with temporary fencing and appropriate BMPs would be implemented to minimize the potential for erosion and/or sedimentation within and adjacent to the project site. Overall, these restoration proposals would result in beneficial effects to the Refuge's native habitat areas.

All of the management activities proposed under Alternative A would also be implemented under Alternative B, and the following additional activities would be implemented under Alternative B:

- Replace the western culvert in the Bolsa Cell with a water control structure;
- Remove concrete and debris from the marsh;
- Expand management and study of light-footed clapper rail habitat;
- Implement surveys for tiger beetles, native plant species, fish, and other vertebrates and invertebrates;
- Implement an IPM program that includes coordinating with NWSSB to expand invasive plant control beyond the Refuge boundary;
- Implement a water quality monitoring program; and
- Monitor tidal channel bathymetry, channel bank stability, and changes related to sea level rise.

Replacement of the existing culvert in the Bolsa Cell with a new water control structure would require excavation within the existing levee and the edges of the adjacent wetland, resulting in temporary impacts to habitat and native vegetation. For the most part, the levee banks are covered with rip rap to reduce the potential for erosion and levee failure. However, some wetland and wetland/upland transition vegetation is present on the banks and along the top of the levee. This vegetation would be removed when the old culvert is removed and the new water structure is constructed. To compensate for the loss of native vegetation, the site of the old culvert and any exposed areas around the new water control structure would be revegetated with appropriate native habitat following construction. Impacts to adjacent subtidal habitat would be temporary and following project completion would be expected to quickly reestablish through natural plant recruitment. All mitigation for the permanent loss of native habitat would be mitigated using replacement ratios appropriate for the affected habitat. The implementation of site appropriate BMPs to reduce erosion, as described in Section 5.2.2.3, would reduce the potential for indirect impacts to surrounding native habitat to below a level of significance.

An excavator with a hydraulic hammer would be used to break apart an estimated 1,400 to 1,600 metric tons of concrete and debris from the marsh. The majority of the construction activity could be implemented from existing roadways located near the site of the debris. Once the material is broken up, it would be loaded by excavator into trucks to be hauled away for appropriate disposal. In those places where the debris extends below the marsh surface, the concrete would be removed with an excavator, and the vacated area would be filled with appropriate material from on site to reestablish the appropriate marsh elevation. The proposed activity could result in temporary impacts to marsh habitat; however, following the removal of the debris from the site, appropriate marsh plants would be installed in disturbed areas to restore the native vegetation. Overall, the proposal would have a beneficial effect on the habitat quality of the marsh.

Proposals related to the expansion of monitoring, species surveys, and habitat studies would require access into sensitive habitat areas, however, with adherence to appropriate protocols for minimizing trampling of vegetation and using non-motorized boats to access remote areas of the marsh, impacts to these habitats would be minimal. To ensure that all efforts to minimize impacts to Refuge resources are implemented, the Refuge Manager would be responsible for developing protocols and sharing this information with all monitors, surveyors, and researchers prior to commencement of specific field activities.

The proposal to increase the opportunities for scientific research on the Refuge could result in minor trampling of vegetation. However, measures to avoid such impacts, involving the inclusion of conditions within individual Refuge Special Use Permits related to where and how sensitive resource areas can be accessed and general oversight of research activities by the Refuge Manager would reduce the potential for adverse impacts to below a level of significance.

Pest Management

Potential effects to Refuge habitat associated with the implementation of the IPM Plan would be minor, temporary, or localized in nature. Along with the selective use of pesticides, the IPM program also describes other appropriate strategies (biological, physical, mechanical, and cultural methods) to eradicate, control, or contain pest species in order to achieve resource management objectives. Based on scientific information and analyses documented in "Chemical Profiles," pesticides allowed for use on the Refuge would be of relatively low risk to non-target species as a result of low toxicity, short persistence in the environment, and implementation of BMPs. The implementation of BMPs related to proper application of each product, precautions to be taken during mixing, and various steps to be taken to avoid overspray or drift (refer to Section 5 of

Appendix C for a complete listing of BMPs) would ensure that adverse effects to non-target vegetation is minimized and/or avoided.

The proposal to expand control of invasive plant species to beyond the boundaries of the Refuge through a cooperative effort with the Navy, would be implemented in accordance with the IPM program and would therefore also have minor, temporary, or localized impacts on native Refuge habitat.

Under this alternative, mosquito management would be implemented in accordance with the Mosquito Management Plan presented in Appendix D. In addition, the OCVCD has requested that the Refuge consider the use of an additional product larvicide, Natular, on the Refuge. Therefore the use of the product is being evaluated as part of this alternative, although is not proposed for use in the Mosquito Management Plan.

The effects of Agnique MMF on salt marsh vegetation are unknown, while spinosad, the active ingredient in Natular, is known to be partly taken up by leaf tissue. Spinosad has a low potential for acute toxicity to aquatic plants and a moderate potential for acute toxicity to algae. USEPA categorizes spinosad as highly toxic to bees. It can also impact species in the orders Lepidoptera and Coleoptera (*Thompson et al. no date*), including some pollinating insects. As a result, use of this product has the potential to adversely affect specific invertebrate-plant interactions (e.g., pollination) on the Refuge.

From a habitat perspective, marine, estuarine, and terrestrial habitats are potentially at risk from spray drift and runoff following a ULV application of products containing phenothrin. The USEPA reports that there are currently no acceptable data available evaluating the toxicity of phenothrin to algae or aquatic macrophytes; therefore, risks to aquatic plants from phenothrin exposure cannot be fully assessed, and remain an uncertainty (*USEPA 2008b*). There are, however, no documented accounts of aquatic plant toxicity from phenothrin and because this compound acts as a neural toxin, phytotoxic effects are unlikely (*USEPA 2008b*). The fact that phenothrin is applied at very low application rates and the Mosquito Management Plan does not allow the application of adulticides over the Refuge's coastal wetland habitat, direct effects to aquatic plants from the application of phenothrin on the Refuge are not anticipated.

The Mosquito Management Plan (Appendix D) includes BMPs that address proper handling and application of pesticides to minimize impacts to non-target species, including plants. These BMPs and the stipulations included in the Compatibility Determination for Mosquito Management (Appendix A-3) would be incorporated in the annual SUP issued to the OCVCD, therefore, ensuring that the potential for adverse effects to sensitive plant resources would be minimized.

Public Use

Alternative B would continue the limited public use program currently conducted on the Refuge, as well as expand opportunities for scientific research on the Refuge. As described for Alternative A, these uses would not result in significant adverse effects to subtidal, intertidal, coastal salt marsh, transitional, and upland habitats.

5.3.3 Alternative C (Proposed Action) – Optimize Upland/Wetland Restoration, Improve Opportunities for Wildlife Observation

Wildlife and Habitat Management

Under Alternative C, the areas of subtidal habitat would not change, but as in Alternative B, areas of nonnative upland habitat would be restored to salt marsh, mudflats, and transitional habitats. Although the proposed restoration sites under Alternative C would be generally the same as under Alternative B, under Alternative C, there would be a greater mix of upland and wetland/upland transitional habitat than is proposed in Alternative B.

A 21-acre area located to the north of Case Road Pond and a 9.4-acre area to the southeast of 7th Street Pond would be restored to a range of habitats including intertidal mudflat, salt marsh, wetland/upland transition, and coastal sage scrub. The intertidal habitats (i.e., mudflat, salt marsh) would also include meandering shallow subtidal channels with gentle side slopes to provide a diversity of microhabitats. A strip of land to the west of 7th Street, an area at the southwestern end of the 7th Street Pond, and the area around the existing drop tower (refer to Figure 3-5) would be restored to wetland/upland transitional habitat and the area located to the east of the drop tower would be restored to salt pan habitat. All of the areas proposed for restoration are currently dominated by nonnative upland vegetation; therefore, no direct impacts to sensitive native habitats would result from the proposed restoration. To avoid indirect impacts to sensitive native habitats during restoration, the implementation of the BMPs described in Section 5.2.2.3, would minimize the potential for erosion or sedimentation in existing native habitat areas. In addition, sensitive habitat located in proximity to a proposed restoration area would be fenced prior to any construction activity to ensure that inadvertent entry into sensitive habitat areas is avoided. Overall, the replacement of nonnative vegetation with native coastal habitat would represent a benefit to the environment.

Other potential beneficial effects of Alternative C related to habitat include the establishment of one or more populations of the Federally listed endangered salt marsh bird's-beak as part of marsh restoration efforts, improving the quality of the Refuge's cordgrass-dominated salt marsh habitat by pumping clean sediment of appropriate grain size and nutrient content onto a portion of the marsh, and restoration of wetland/upland habitat in the vicinity of the drop tower.

In addition to restoration, Alternative C includes a number of other management activities intended to support the trust resources on the Refuge. These management activities include those proposed under Alternatives A and B (the potential effects of which have been addressed previously), as well as the following additional activities that could have an effect on habitat or vegetation:

- Manage some areas of salt pan and upland habitat to support tiger beetles;
- Establish one or more populations of salt marsh bird's-beak on the Refuge;
- Improve the habitat quality of the Refuge's cordgrass-dominated salt marsh habitat; and
- Remove the drop tower located near 7th Street Pond.

Under Alternative C, a management plan would be developed to determine how best to manage existing salt pan and wetland/upland transition areas to support the various species of tiger beetles present on the Refuge. Until the management plan is prepared, it is not possible to determine all of the actions that may be proposed for implementation; however, it is anticipated that these actions would result in improvements to existing and/or restored habitat and would not have any adverse effects of sensitive habitats or vegetation.

The removal of the drop tower located at the end of 7th Street would allow for full restoration of the area in and around the current site of the drop tower to native habitat, therefore, no impacts to sensitive habitat or vegetation would result from this proposal.

Also under this alternative, efforts to understand and improve the quality of the Refuge's cordgrass-dominated salt marsh habitat would be expanded beyond the study described in Alternative B to include consideration for examining the effectiveness of pumping clean sediment of appropriate grain size and nutrient content onto a portion of the marsh as illustrated in Figure 3-5. Enough sediment would be distributed over the existing vegetation to provide for a slight increase in the elevation of the marsh plain, while still enabling the vegetation to grow up through the added sediment. This activity, which would be limited to a few locations within the marsh, is intended to improve the vigor and overall health of the cordgrass, therefore, the temporary impacts to these areas would be offset by improved habitat value following establishment of the affected cordgrass vegetation.

Pest Management

The analysis of potential effects to habitat quality from the implementation of the IPM and Mosquito Management Plans would be generally the same under this alternative as described previously for Alternative B. Natular would not be permitted for use on the Refuge under this alternative.

Public Use

The visitor services opportunities described in Alternative A would continue to occur under Alternative C. As described for Alternative A, these uses would not result in significant adverse effects to sensitive habitats or vegetation. Alternative C also includes proposals that would expand to a limited extent the existing public uses already implemented on the Refuge. The expansion of these uses, which would include additional Refuge tours and/or bird watching events, would not result increase the potential for impacts to sensitive habitats. The site of the proposed two-level, 20-foot-high observation tower, which is located along the east side of Kitts Highway across from the Refuge headquarters, does not currently support native vegetation; therefore, no adverse effects to sensitive habitat or vegetation would occur as a result of this project.

5.4 Effects to Wildlife and Fisheries

The effects to wildlife and fisheries as a result of implementing the various alternatives are described below. Once again, potential impacts to these resources are characterized by evaluating direct, indirect, and cumulative effects. Direct impacts involve the primary effect of implementing an action, such as the flushing of foraging shorebirds as a result of wildlife observation activities. Indirect impacts include habitat modifications that result in a change in abundance or breeding success of a species (or group of species), such as increasing the availability of fish in the vicinity of seabird nesting areas following levee breaching. Cumulative impacts would occur when the incremental direct or indirect impact of an action is added to other related actions that would affect the same species (or group of species), such as the effect of expanding nesting habitat for the light-footed clapper rail on the Refuge combined with similar habitat expansion elsewhere in the region. An effect to wildlife and fisheries would be considered significant if:

- An action would result in a substantial change in the amount or quality of available habitat of a wildlife species.

- An action would result in a substantial adverse effect, either directly or through habitat modifications, on any wildlife or fish species identified as a sensitive or special status species in local or regional plans, policies, regulations, by California Department of Fish and Game (CDFG), or USFWS or any avian species identified as a Bird of Conservation Concern.

- There would be a permanent loss of occupied sensitive species habitat or the direct mortality of individuals of sensitive species as a result of a proposed action.

- An action would substantially interfere with the movement of any native resident or migratory wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites for longer than two weeks.

- There would be a substantial reduction in the population abundance of fish species inhabiting Anaheim Bay as a result of a proposed action.

- An action would substantially change in the availability of habitat for fish.

A significant cumulative impact would result from habitat modifications affecting wildlife and/or fish that would be considered minor for the proposed action but when considered in light of other similar losses within the region would be considerable.

5.4.1 Alternative A – No Action

5.4.1.1 Effects to Waterfowl, Seabirds, Shorebirds, and Other Waterbirds

Wildlife and Habitat Management

Under Alternative A, current wildlife and habitat management activities on the Refuge, including invasive plant control, trash and debris removal, culvert maintenance and replacement, environmental contaminants coordination, native upland plant restoration, species surveys, and predator management, would continue. As described in the section above, these activities would not result in significant adverse effects to sensitive habitats, including habitats that support foraging, resting, or breeding birds. However, these activities could result in the flushing of foraging or nesting birds. To minimize the effects of such disturbance, management activities with the potential to disturb nesting birds are generally limited to periods outside the breeding season, and where such activities must occur during the nesting season, they are not conducted in proximity to known or potential nesting areas. In addition, activities related to surveys, monitoring, and invasive plant species control are generally limited to one or two days a month and generally for periods not longer than two to four hours. The Refuge Manager also schedules these activities to avoid peak migration periods. Through the implementation of these considerations, the potential for significant adverse effects related to changes in the presence, populations, or distribution of waterbirds on the Refuge is less than significant. Further, the implementation of these activities is considered cumulatively beneficial.

The implementation of the Endangered Species Management and Protection Plan (*USFWS and Navy 1990*) has resulted in the loss of one great blue heron (*Ardea herodias*). In 2007, lethal removal of the great blue heron was required after the heron was observed eating least tern chicks. In total, four chicks were confirmed taken by this heron (*Ross 2007*). No predation by herons was observed in subsequent years, however, there is the potential that the lethal take of a heron could occur again in the future if an individual heron is thought to pose a risk to a listed species supported on the Refuge. Because the lethal take of a heron is a very rare event, the

continued implementation of predator management on the Refuge would not represent a significant impact to the heron population on the Refuge.

Pest Management

Mechanical and chemical control of invasive weedy plants is conducted on the Refuge primarily within the disturbed uplands that surround the salt marsh complex. Some invasive plant control also occurs on the least tern nesting site on NASA Island and on Hog Island, a natural upland area on the Refuge. This activity can result in disturbance to migratory birds; however to minimize the potential for adverse effects, control of invasive plants is not conducted in proximity to known nesting areas during the nesting season and invasive plant control is only implemented periodically throughout the year.

The primary herbicides used on the Refuge contain the active ingredient glyphosate. These herbicides, including Aquamaster and Glyphosate Pro 4, are post emergent, systematic herbicides with no residual soil activity. These products are acceptable for use in wetland areas and wildlife management areas and if used in accordance with the product label, would not adversely affect waterbirds. Surflan AS, containing the active ingredient oryzalin, is used strictly in upland areas to control saltbush, Bermuda grass, mustard, salt cedar, and other invasive weeds. This product is a pre-emergent, surface-applied chemical that does not control emerged weeds. When used in accordance with label instructions, this product will not adversely affect waterbirds or other wildlife. Habitat, containing the active ingredient imazapyr, is used on the Refuge to control perennial pepperweed, myoporum, Brazilian pepper, and other invasive shrubs and trees. USEPA (*2006a*) has determined that this product poses no risks of concern to birds.

The pesticides currently used by the OCVCD to control mosquito populations on the Seal Beach NWR have been approved through the PUP review process. These pesticides include the larvicides *Bacillus thuringiensis israelensis* (Bti) and *Bacillus sphaericus* (Bs) and Altosid®, a biochemical pesticide with the active ingredient methoprene. Methoprene is to be used on the Refuge only as a second line of defense.

Testing indicates that when Bti and Bs are used according to label directions these microbial pesticides pose no significant direct effect to non-target species or the environment (*USEPA 2007b*). The products are not considered toxic to mammals, birds, fish, and most non-target invertebrates (insects and worms) (*Davis and Peterson 2008*); however, some research indicates that there may be indirect effects on the ecosystem as a result of multiple applications of these products. These effects relate to disruptions in the invertebrate food web that can affect non-target wetland fauna (*Hershey et al. 1998, Poulin et al. 2010*). According to USEPA evaluations of ecological effects on mallard ducks and bobwhite quail, methoprene is considered practically non-toxic to birds (*USEPA 2001*).

The Compatibility Determination for Mosquito Management (Appendix A-3) includes a list of stipulations that when implemented would ensure the compatibility of this use with the purposes of the Refuge and the mission of the Refuge System. These stipulations also serve as mitigation to ensure that no significant adverse effects to Refuge resources would result from the implementation of mosquito monitoring and control on the Refuge.

Public Use

Public tours of the Refuge are generally limited to the areas around the visitor contact station and the trail that extends along Bolsa Avenue from Kitts Highway to the existing observation deck. The potential for flushing waterbirds from these locations is relatively low because of the distances between the public use areas and high use waterbird habitat. Additionally, public tours are only

conducted once a month, so the overall effect on wildlife from this activity is low. Special bird watching tours are also conducted on the Refuge, but most of the bird observation is conducted from existing roads or pathways. Although there is a greater potential for flushing foraging birds during these events than from general public tours, disturbance is still considered relatively low. Therefore, the continuation of the limited public use program as currently conducted on the Refuge is not expected to cause adverse effects to waterfowl, seabirds, shorebirds, and other waterbirds.

5.4.1.2 Effects to Landbirds

Wildlife and Habitat Management

The effects to landbirds as a result of implementing the wildlife and habitat management activities proposed under Alternative A would be similar to those described for waterbirds. Specifically, actions related to invasive species control, surveys and monitoring, trash and debris removal, and culvert maintenance/replacement could result in some disturbance to landbirds, however, the extent and duration of disturbance would be limited and all activity in potential nesting areas would be avoided during the nesting season.

Predator management conducted on the Refuge in accordance with the Endangered Species Management and Protection Plan (*USFWS and Navy 1990*) would continue to result in the loss of some individual landbirds considered a threat to the endangered California least tern and light-footed clapper rail. The effects of predator management on landbirds was addressed in detail in the Endangered Species Management and Protection Plan EIS prepared by the Service and the Navy in 1990 and the Record of Decision, which was signed in 1991. Both documents are incorporated by reference into this EA. The Endangered Species Management and Protection Plan EIS (*USFWS and Navy 1990*) concludes that the removal of a few problem raptors would not affect the overall population levels of any species of raptor supported on the Refuge or NWSSB. In addition, implementation of predator management would benefit ground-nesting birds, such as mourning doves and killdeer.

Between 2007 and 2009, the number of landbirds controlled to protect endangered species was very low. In 2007, three ravens were lethally removed from the site and a red-tailed hawk (*Buteo jamaicensis*) and a kestrel (*Falco sparverious*) were trapped and transported to a distant location for release (*Ross 2007*). In addition, non-lethal hazing of peregrine falcons (*Falco peregrinus*) was implemented after frequent intrusions into the least tern nesting site were observed. Although labor intensive, hazing proved to be very effective at discouraging falcons from entering the nesting colony. In 2008, two kestrels were trapped and transported to a distant location for release, and peregrine falcons and a female northern harrier (*Circus cyaneus*) were successfully hazed from the nesting colony (*Ross 2008*). American kestrels were once again observed hunting in the nesting colony in 2009. This resulted in two kestrels being live trapped and transported to an offsite location for release. An additional kestrel had to be lethally removed. Hazing was effective in discouraging a red-tailed hawk and a peregrine falcon from hunting in the site (*Ross 2009*).

Based on the small number of landbirds lost to predator control, the continuation of past predator management practices is not expected to result in any significant changes in the current population of landbirds on the Refuge or NWSSB.

Pest Management

As described above, birds foraging and nesting on the Refuge are not considered at risk as a result of the use of the herbicides and mosquito control products currently being used on the Refuge.

However, some research indicates that there may be indirect effects on the ecosystem as a result of multiple applications of mosquito control products. These effects relate to disruptions in the invertebrate food web that can affect non-target fauna (*Hershey et al. 1998, Poulin et al. 2010*). For instance, the availability of prey for birds such as swallows could be adversely affected over time. There is however limited research on this topic, therefore, the degree to which Refuge birds could be impacted is not known.

Public Use

The effects to landbirds as a result of continuing the limited public use program currently conducted on the Refuge would be similar to those described above for waterbirds. No significant adverse impacts to landbirds are therefore anticipated.

5.4.1.3 Effects to Fish and other Marine Organisms

Wildlife and Habitat Management

Continuing to conduct wildlife and habitat activities related to trash and debris removal, invasive plant control, culvert maintenance and periodic replacement, environmental contaminants coordination, native upland plant restoration, species surveys, and predator management would have limited potential for impacts to fish and marine organisms. Of the management activities proposed under Alternative A, culvert maintenance/replacement and invasive plant control would have the potential for adverse impacts to fish and other marine organisms if BMPs are not implemented as part of these activities. To avoid any adverse effects to these species, activities related to the inspection, cleaning, and/or replacement of culverts would include the implementation of BMPs. Culverts are generally inspected on an annual basis and cleaned every five to ten years, if needed. Replacement only occurs if there is significant evidence of corrosion. To reduce the potential for impacts to fish and other marine organisms from these activities, BMPs, as described in Section 5.2.1.6, would be implemented to minimize the introduction of sediment into the Refuge's wetland areas, reduce the potential for increased turbidity levels within the water column, prevent general degradation of water quality, reduce the potential loss of fish during construction, and avoid impacts to eelgrass habitat. Any impacts to eelgrass habitat would be mitigated in accordance with the requirements of the Southern California Eelgrass Mitigation Policy, adopted July 31, 1991.

Pest Management

As described in Section 5.4.1.1, invasive plant control on the Refuge currently involves mechanical removal, as well as the application of herbicides. Glyphosate-based herbicides are post emergent, systematic herbicides acceptable for use in wetland areas. If used in accordance with the product label, these products pose no hazard to fish or other marine organisms. Specifically, terrestrial formulations of these herbicides are only used in upland areas and a minimum buffer of 50 feet is maintained between application areas and adjacent wetlands. Additionally, on this Refuge, aquatic formulations of glyphosate-based herbicides are only used along the margins of wetland areas and a minimum buffer of 25 feet is maintained between the application area and the adjacent wetland.

Surflan AS, which contains the active ingredient oryzalin, is toxic to fish and therefore is not permitted for use in wetland areas. When used in accordance with label instructions and in association with BMPs, this product is not expected to adversely affect fish or other marine organisms.

Further, microbial larvicides and methoprene are used on the Refuge by the OCVCD to control mosquitoes. When applied in accordance with label directions, microbial larvicides (Bti and Bs) are not expected to pose a risk to fish or other marine organisms.

Methoprene applied at levels recommended on the label are not likely to be toxic to non-target species. For example, methoprene was found to have an effect on copepods, crabs, and shrimp, although these effects were generally observed at concentrations higher than those of operational rates (*Bircher and Ruber 1988, Marten et al. 1993, Hershey et al. 1998*). According to the latest USEPA fact sheet for methoprene (*USEPA 2001*), data generated under laboratory and field conditions indicate that methoprene mosquito product formulations, including slow release briquette formulations, have a maximal rate of release of ≤ 4 parts per billion (ppb). The typical amount of methoprene necessary for mosquito control is < 1.0 ppb. The initial concentrations of Methoprene when applied to aquatic habitats may reach 4 to 10 ppb, but residual concentrations are approximately 0.2 ppb (*Ross et al. 1994*). Most non-target organisms support margins of safety of >200 ppb, therefore, exposure to methoprene would not be expected to reach levels which are toxic to aquatic non-target species either after acute or chronic exposure. Once methoprene is released into the aquatic environment, it is non-persistent with a half-life of about 30-40 hours.

The conclusions of a few longer term studies of the effects of Bti and methoprene on the environment do however indicate that repeated use of these products may have indirect effects related to disruptions in the invertebrate food web that could affect non-target wetland fauna (*Hershey et al. 1998, Poulin et al. 2010*). The general conclusion of these studies is that an integrated approach to mosquito control is necessary to avoid long term detrimental effects on the environment that appear to be occurring as a result of the continuous (year after year) application of these types of pesticides within a given area (*Hershey et al. 1998, Walker et al. 2005, Tilquin et al. 2008, Poulin et al. 2010*). To minimize the potential for impacts to fish and other marine organisms from mosquito control, the OCVCD's Special Use Permit limits the application of these products to areas around the perimeter of the salt marsh complex.

Public Use

The current public use program does not include any uses with the potential to impact fish or marine organisms. Research activities are directed by the Refuge Manager through Special Use Permits that include project specific conditions to avoid any adverse effects to Refuge resources. Therefore, no adverse effects to fish or marine organisms would result from the continuation of these programs.

5.4.1.4 Effects to Terrestrial Invertebrates, Amphibian, and Reptiles

Wildlife and Habitat Management

The Refuge management activities that would continue under Alternative A would have limited potential for impacts to terrestrial invertebrates, amphibians, or reptiles in part because population numbers and appropriate habitat to support these organisms is relatively low on the Refuge. Mechanical removal of invasive vegetation could adversely affect some individuals, but such losses would be low and therefore not considered significant. In areas that have the potential to support tiger beetles, habitat disturbance associated with Refuge management is minimized to the maximum extent practicable. Generally, nonnative plant control and culvert maintenance are not required in these areas. Other activities such as trash removal, surveys/monitoring, and predator control when conducted in these areas, are limited to reduce the potential for direct and indirect impacts to these invertebrates.

Pest Management

Based on available literature, the USEPA has concluded that glyphosate is practically nontoxic to invertebrates, including honeybees (*USEPA 1993*). The use of products with the active ingredient oryzalin is not expected to impact terrestrial invertebrates, amphibians, or reptiles. In addition, oryzalin is classified as practically nontoxic to honey bees (*USEPA 1994*). According to the

USEPA ecotoxicity criteria, imazapyr is practically non-toxic to insects; however, little data is available regarding the toxicity effects of imazapyr to reptiles and amphibians. Adherence to the label requirements of these products and implementation of BMPs related to herbicide application will ensure that the use of these products on the Refuge will not adversely affect invertebrates or any reptiles and/or amphibians present on the Refuge.

Mosquito control involving the use of Bti and Bs are also not expected to significantly impact these organisms. The USEPA, after considering the available studies, has concluded that methoprene applied at levels recommended on the label is of low toxicity and poses very little hazard to non-target species (*USEPA 2001*). However, earlier studies of some species in the order Coleoptera did show some sensitivity to methoprene (*Marten et al. 1993*). This is of concern on the Refuge because at least two of the areas currently being treated for mosquitoes are believed to support one or more species of tiger beetles (in the order Coleoptera). A search of the existing literature did not find any studies that evaluated the effect of methoprene on tiger beetles; therefore, the risk of using this product in areas where these organisms occur is unknown. To avoid potential impacts to sensitive tiger beetle species, under this alternative, future SUPs for mosquito control will restrict the use of methoprene to those areas of the Refuge that are not known or expected to support high numbers of tiger beetles.

Public Use

Public use activities are primarily limited to existing roads and pathways, therefore, no adverse effects to terrestrial invertebrates, amphibians and reptiles would result from the continuation of the existing public use program on the Refuge.

5.4.1.5 Effects to Mammals

Wildlife and Habitat Management

The management activities proposed under Alternative A would have minimal effect on the mammal populations that occur on the Refuge. The activity with the greatest potential for impact to mammals is predator management, which is implemented as part of the Endangered Species Management and Protection Plan (*USFWS and Navy 1990*). Additional information about this plan is provided in Section 3.4.3.1.

Implementation of the predator management plan between 2007 and 2009 has only resulted in the lethal control of one mammal, a coyote (*Canis latrans*) in 2007. This individual was responsible for predating approximately 160 least tern nests before it was removed from the site (*Ross 2007*). In 2008, a small barrier fence was installed on each side of the site near the entrance to nesting area, to further discourage coyote activity in the vicinity of the nesting site. This management action proved effective. No evidence of coyote activity was observed near the site; therefore, no direct control of coyotes was required in 2008 or 2009. Based on past actions, continuing the existing predator management plan would not adversely affect the mammal populations on the Refuge.

Pest Management

The active ingredients glyphosate, oryzalin, and imazapyr are all considered to be practically nontoxic to mammals by the USEPA (*USEPA 1993, 1994, and 2006b*); therefore, no adverse affects to mammal present on the Refuge are anticipated as a result of the continued use of these products in accordance with label requirements and the implementation of appropriate BMPs.

According to the USEPA, various tests conducted for Bti and Bs revealed no expected harm to non-target organisms, therefore, when applied in accordance with label directions, microbial larvicides (Bti and Bs) are not expected to pose a risk to mammals. Studies also demonstrate that

in mammals, methoprene is rapidly and completely broken down and excreted, mostly in the urine and feces. It is considered non-persistent and non-toxic to mammals and presents no long-term hazard to mammals at recommended application rates (*IPCS no date*).

Public Use

None of the public use activities implemented on the Refuge would have the potential for adverse impacts to mammals, as all activities are limited to existing roads and pathways.

5.4.2 Alternative B – Maximize Salt Marsh Restoration, Continue Current Public Uses

5.4.2.1 Effects to Waterfowl, Seabirds, Shorebirds, and Other Waterbirds

Wildlife and Habitat Management

Under this alternative, all of the actions described in Alternative A would also be implemented. Therefore, the effects on waterbirds of implementing these specific actions would be the same as those described above for Alternative A.

In addition to the actions described in Alternative A, Alternative B would also involve the restoration of approximately 36 acres of disturbed upland to tidal wetland and wetland/upland transition habitat; the replacement of the existing culverts in the Bolsa Cell levee with a water control structure; the removal of concrete debris from the marsh; and the implementation of an IPM program for the Refuge. Restoration, installation of a water control structure, and removal of concrete debris would all result in temporary adverse impacts to waterbirds due to increased noise levels and overall disturbance from construction equipment. To avoid impacts to nesting birds, all construction activity would occur outside of the breeding season. The level of disturbance would also be minimized through appropriate siting of construction access routes. Access would be taken from areas furthest from existing wetlands. In addition, temporary fencing would be installed to delineate the construction site and keep construction equipment out of habitat areas. Although impacts related to disturbance would be adverse to foraging and resting waterbirds, these impacts would be short in duration and limited in area, therefore, the anticipated disturbance would be less than significant. Once completed, these actions would benefit waterbirds by improving habitat quality and/or providing additional areas for foraging and resting.

Installation of a water control structure within the Bolsa Cell levee would also provide enhanced management capabilities over the amount of tidal flow entering or exiting the Bolsa Cell. This would improve the function and habitat values of this area for waterbirds. Other additional actions associated with this alternative may also benefit waterbirds by improving the quality and quantity of habitat. For example, monitoring tidal channel bathymetry and channel bank stability, as proposed, could help protect natural marsh edges for shorebird foraging and as refugia for migratory bird during high tides.

Pest Management

Under Alternative B, the control of pests on the Refuge would be conducted using an integrated approach to pest management. The control of pests, other than mosquitoes, will be conducted in accordance with the IPM Plan prepared for the Seal Beach NWR (Appendix C), while mosquito monitoring and control would occur in accordance the Mosquito Management Plan (Appendix D). Under this alternative, Natular, used to control mosquito larvae, would also be permitted for use on the Refuge.

Herbicide use currently being implemented on the Refuge, as described for Alternative A would also continue under this alternative. Additional products may also be approved for the Refuge in

the future through the PUP approval process. Under the IPM Plan, the potential effects to Refuge resources from the proposed site-, time-, and target-specific use of current and potentially future pesticides on the Refuge would be evaluated using scientific information and analyses documented in "Chemical Profiles" of the IPM Plan (Appendix C). These profiles provide quantitative assessment/screening tools and threshold values to evaluate potential effects to species groups (e.g., birds, mammals, and fish). A PUP (including appropriate BMPs) is approved where the Chemical Profiles provide scientific evidence that potential impacts to biological resources are likely to be only minor, temporary, or localized in nature. Along with the selective use of pesticides, the IPM Plan proposes other appropriate strategies (i.e., biological, physical, mechanical, cultural methods) to eradicate, control, or contain pest species in order to achieve resource management objectives. Based on scientific information and analyses documented in "Chemical Profiles" (see Appendix C), pesticides allowed for use on the Refuge would be of relatively low risk to non-target organisms as a result of low toxicity or short-term persistence in the environment. Therefore, waterbirds would not be substantially affected as a result of the use of these pesticides.

The proposal to expand control of invasive plant species to beyond the boundaries of the Refuge through a cooperative effort with the Navy, would be implemented in accordance with the IPM Plan and would therefore also have the potential for only minor, temporary, or localized impacts to waterbirds.

Mosquito management proposed under this alternative would also be conducted through an integrated, phased approach in part to minimize the potential for impacts to wildlife. However, as described under Alternative A, most chemical control of mosquitoes can result in direct and indirect adverse effects to one or more non-target species. The altered ecological communities that may result from these control efforts can impact biological integrity and diversity through disruptions in food webs and other ecological functions. The effect to some waterbirds could be a temporary reduction in prey species at or near the control site. Some pesticides also have the potential to directly impact individual birds, as described in greater detail below.

The OCVCD has requested permission to use three new products to control mosquitoes on the Refuge: Natular, a larvicide with the active ingredient spinosad; Agnique®, a larvicide and pupacide made from renewable plant oils; and Anvil™ in the forms AquaAnvil™ and Anvil 10+10 ULV, both used in adult mosquito control. The label for Natular identifies this product as toxic to aquatic organisms. In addition, non-target aquatic invertebrates may be killed in waters where this pesticide is applied. Agnique is potentially lethal to any aquatic insect that lives on the water surface or requires contact with the air-water interface. As a result, the use of either of these products on the Refuge could have indirect, albeit limited, effects on the food base of bird species that prey on aquatic insects.

In considering direct effects on birds, spinosad, the active ingredient in Natular, shows slight toxicity to birds, while Agnique, which is considered to be "practically nontoxic," is not known to cause direct chronic or acute toxicological effects to birds.

Based on studies of avian acute dietary toxicity and avian acute oral toxicity tests, USEPA (*2008b*) classifies phenothrin as practically non-toxic to avian species. Piperonyl butoxide, the other component of sumithrin, is also considered practically nontoxic to birds on an acute basis (*USEPA 2006c*). In addition, USEPA has concluded that there is low likelihood of chronic risks to birds from phenothrin use (*USEPA 2008b*). The application of AquaAnvil and Anvil 10+10 ULV on the Refuge could however pose a threat to non-target species, such as birds (due to disturbance

associated with the application of these products) and to the prey upon which birds may forage (due to pesticide drift).

AquaAnvil and Anvil 10+10 ULV are applied as ultra-low volume sprays meant to target adult mosquitoes as they fly. When applied, the mist consists of very small liquid droplets that range in size from eight to 30 microns (*Davis et al. 2007*). The insecticide in the droplets is absorbed through the insect cuticle and takes effect soon after contact. If these droplets were to enter the shallow tidal waters of the Refuge's marsh habitat, estuarine invertebrates in these areas could be adversely affected, as both phenothrin and piperonyl butoxide are considered highly toxic to estuarine invertebrates (*USEPA 2006c and 2008b*). The result could be a temporary decrease in the availability of waterbird prey species in some portions of the Refuge. The effects of pesticide drift and disturbance would be reduced through restrictions in the SUP on when and where adulticides can be applied on the Refuge; the concurrent application of approved larvicides and/or pupacides on the site to prevent future adult outbreaks, thus reducing the potential for subsequent spraying of adulticides; and strict adherence to label requirements.

Public Use

As no new public use opportunities are proposed under Alternative B, the effects to waterbirds would be the same as those described for Alternative A.

5.4.2.2 Effects to Landbirds

Wildlife and Habitat Management

All of the actions described in Alternative A (e.g., predator management, invasive plant control, culvert maintenance and/or replacement, monitoring) would also be implemented under Alternative B. Therefore, the effects of implementing these specific actions on landbirds would be the same as those described for Alternative A.

New actions proposed under Alternative B include the restoration of approximately 36 acres of disturbed upland to tidal wetland and wetland/upland transition habitat; the replacement of the existing culverts in the Bolsa Cell levee with a water control structure; the removal of concrete debris from the marsh; and the implementation of an IPM program for the Refuge. The restoration proposals included under Alternative B would eliminate some of the low-quality upland habitat present on the Refuge, replacing it with salt marsh and wetland/upland transition habitats. The proposal to convert disturbed upland habitat to native tidally influenced habitat would displace some resident or migratory landbirds, however, the numbers of landbirds affected would be low and no listed or special status landbird species would be affected. Therefore, the effect on landbirds of restoring habitat in accordance with Alternative B would be less than significant. Changes to the water control structures in the Bolsa Cell and the removal of concrete from the marsh would have no effect on landbirds.

Pest Management

The potential for direct effects to landbirds from the implementation of the IPM Plan and Mosquito Management Plan would be similar to those described in Section 5.4.2.1.

The expansion of mosquito control to include the use of a spinosad, monomolecular films, and adulticides with the active ingredient sumithrin could result in temporary and generally localized reductions in the availability of insect prey for upland birds due to the potential for these products to kill some non-target insect species (see Section 5.4.2.4 for additional details). This situation could adversely affect biological integrity and diversity on the Refuge through disruptions in food

webs and other ecological functions. The implementation of the measures described in Section 5.4.2.1 would also minimize the effects of spray drift and disturbance on landbirds.

Public Use

As no new public use opportunities are proposed under Alternative B, the effects to landbirds would be the same as those described for Alternative A.

5.4.2.3 Effects to Fish and Other Marine Organisms

Wildlife and Habitat Management

Under this alternative, all of the actions described in Alternative A would also be implemented. Therefore, the effects to fish and other organisms of implementing these specific actions would be the same as those described above for Alternative A.

In addition to the actions described in Alternative A, Alternative B would also involve the restoration of approximately 36 acres of disturbed upland to tidal wetland and wetland/upland transition habitat; the replacement of the existing culverts in the Bolsa Cell levee with a water control structure; the removal of concrete debris from the marsh; and the implementation of an IPM program for the Refuge. Restoration, installation of a water control structure, and removal of concrete debris would all have the potential for adverse impacts to fish and other marine organisms if BMPs are not implemented as part of project implementation. To avoid any short or long term adverse effects to these species, BMPs, as described in Section 5.2.1.6, would be implemented to minimize the introduction of sediment into the Refuge's wetland areas, reduce the potential for increased turbidity within the water column, prevent general degradation of water quality, reduce the potential loss of fish during construction, and avoid impacts to eelgrass habitat.

Pest Management

The pest management actions described under Alternative A would likely continue as part of the proposed IPM Plan to be implementation under Alternative B. Therefore, the potential effects of continuing to use the pesticides described under Alternative A would also occur under this alternative. In addition, under the IPM Plan any new pesticide products proposed for use on the Refuge would be evaluated using scientific information and analyses documented in "Chemical Profiles." Following this procedure would ensure that potential impacts to biological resources, including fish and other marine organisms, would be minor, temporary, or localized in nature. Additionally, this evaluation would ensure that appropriate BMPs can be implemented to further control the potential effects of the proposed product. Thus, potential impacts to fish and other marine organisms from implementing the proposed IPM Plan would be less than significant.

The proposal to expand control of invasive plant species to beyond the boundaries of the Refuge through a cooperative effort with the Navy, would be implemented in accordance with the IPM Plan and would therefore be unlikely to have any effect on fish or marine organisms.

Implementation of the Mosquito Management Plan, which presents a phased approach to mosquito control on the Refuge, could result in the use of additional pesticides on the Refuge. Expanding the types of mosquito control used on the Refuge per the OCVCD's request (which require approval through the PUP review process) would result in potential impacts to fish and marine organisms as described below.

Natular is considered toxic to aquatic organisms and non-target aquatic invertebrates may be killed in waters where this pesticide is applied. The liquid form of spinosad, the active ingredient in Natular, is highly toxic to marine mollusks on an acute basis. Spinosad is also identified as

moderately toxic to fish. Intertidal habitat extends almost to the edges of the Refuge; therefore, the use of this product even in the areas currently designated for mosquito control could adversely affect the marine organisms present in these estuarine habitats.

Agnique is considered to be "practically nontoxic." Studies show no effects on the various life stages of long-nose killifish, fiddler crab, snail, or marine plants. This product is however potentially lethal to any aquatic insect that lives on the water surface or requires contact with the air-water interface. As a result, its use on the Refuge could have adverse indirect effects on the food base of fish species that prey on aquatic insects, but these effects are considered minimal.

Synthetic pyrethrin/piperonyl butoxide products, such as AquaAnvil™ and Anvil 10 +10 ULV, used to control adult mosquitoes, are moderately toxic (LC50 = 3.94 ppm) to estuarine and marine fish and highly toxic to estuarine invertebrates (LC50 = 0.49 ppm) (*USEPA 2006b*). The Material Safety Data Sheet (*August 2006*) for AquaAnvil™ states that this product is toxic to aquatic organisms, including fish and aquatic invertebrates, and according to the product label should not be applied to "bodies of water (lakes, rivers, permanent streams, natural ponds, commercial fish ponds, swamps, marshes or estuaries), except when necessary to target areas where adult mosquitoes are present, and weather conditions will facilitate movement of applied material away from the water in order to minimize incidental deposition into the water body." The active ingredient piperonyl butoxide is considered by the USEPA to be moderately toxic (LC50 = 3.94 ppm) to estuarine and marine fish and highly toxic to estuarine invertebrates (LC50 = 0.49 ppm) (*USEPA 2006b*). The marine organisms supported in the Refuge's estuarine habitats would likely be adversely affected if this product is applied in a manner that would result in measurable drift of the product over sensitive wetland areas.

To minimize the adverse effects to marine and estuarine organisms and the species that forage on these organisms, the use of sumithrin products (adulticides) on the Refuge would only be permitted when pathogen activity is documented in mosquito pool(s) on the Refuge and a public health emergency has been declared by the appropriate health authority servicing the area in which the Refuge is located. Additional measures to minimize the potential impacts to fish and other marine organisms involve spatial and temporal separation of aerosol applications in proximity to sensitive wetland areas and pre-application evaluation of wind speed, direction, and presence or absence of a temperature inversion to ensure that product drift can be managed to avoid entering wetland areas or other areas that may support sensitive non-target organisms. Implementation of these measures, as well as the BMPs outlined in Appendix D, the stipulations in the Compatibility Determination for Mosquito Management, and the conditions included in annual SUPs would ensure that impacts to fish and other marine organisms are minimized and temporary in nature.

Public Use

As no new public use opportunities are proposed under Alternative B, the effects to fish and other marine organisms would be the same as those described for Alternative A.

5.4.2.4 Effects to Terrestrial Invertebrates, Amphibians, and Reptiles

Wildlife and Habitat Management

Reptiles and amphibians are generally not well represented within salt marshes and marine habitats, and the limited amount of upland area on the Refuge generally supports low quality nonnative habitat. As a result, species diversity of these organisms on the Refuge is low. The Refuge management activities described in Alternative A would also be implemented in

Alternative B, and as previously described, these activities would not result in any significant impacts to terrestrial invertebrates, amphibians, or reptiles.

The proposed restoration of the majority of the Refuge's remaining disturbed upland habitat to tidally influenced habitat could adversely affect some individuals of native terrestrial invertebrates and reptiles, but such losses would be low and therefore not considered significant. In areas around the 7th Street Pond, where tiger beetles may be present, a more detailed survey of potential tiger beetle habitat would be conducted prior to completing specific restoration plans for adjacent upland areas. If important tiger beetle habitat is identified, preservation of that habitat, as appropriate, would be incorporated into the future restoration design for that area.

Pest Management

Implementation of the draft IPM Plan for the Refuge (Appendix C), as described above, would ensure that no adverse effects to the Refuge's terrestrial invertebrates, amphibians, or reptiles would occur as a result of the use of pesticides. Studies indicate sensitivity of some species in the order Coleoptera to methoprene (*Marten et al. 1993*). This is of concern on the Refuge because at least two of the areas currently being treated for mosquitoes are believed to support one or more species of tiger beetles (in the order Coleoptera). A search of the existing literature did not find any studies that evaluated the effect of methoprene on tiger beetles; therefore, the risk of using this product in areas where these organisms occur is unknown. To avoid any adverse effects to tiger beetles, a stipulation in the Compatibility Determination for mosquito use (Appendix A-3) is to prohibit the use of Altodsid in areas of the Refuge that are known or expected to support high numbers of tiger beetles.

Of the mosquito control products proposed for use on the Refuge under this alternative, Natular, AquaAnvil, and Anvil 10 + 10 ULV all have the potential to adversely affect terrestrial invertebrates. Spinosad, the active ingredient in Natular, is a broad-spectrum pesticide but is only active if ingested or contacted while in liquid form. The USEPA categorizes spinosad as highly toxic to bees, with topical acute activity of less than 1 microgram per bee. It also impacts species in the orders Lepidoptera and Coleoptera (*Thompson et al. no date*). Some spinosad products are used to kill fire ants, a soil dwelling species. It is not known if these or other spinosad-based products could have adverse effects on native ants or other soil fauna. As a result, native pollinators and other non-target species could be at risk should this product be used on the Refuge.

According to the USEPA (*2008b*), phenothrin is highly toxic on an acute contact basis to non-target terrestrial insects, particularly to honeybees. Honeybees could also face indirect dietary risks from phenothrin toxicity. Piperonyl butoxide, which is also present in the adulticides proposed for use of the Refuge, increases the toxicity of phenothrin to non-target insects (*USEPA 2006c*). Because the control of adult mosquitoes would likely be required between the months of April and October, the time of year when non-target insects are most active, the potential for non-target insect to be exposed to sumithrin during its application would be considered high. Therefore, the application of sumithrin may pose significant acute risks to non-target insects.

A number of studies have been conducted to evaluate the effects of ultra-low volume pesticide applications on non-target insects of various kinds. Boyce et al. (*2007*) in studying the effects of the aerial application of a pyrethrin insecticide synergized with piperonyl butoxide found no adverse effects to larger arthropods such as dragonflies, butterflies, spiders, and honeybees, but did identify a measurable impact on a wide range of small-bodied organisms. It is noted in the study that "although the diversity of affected species was high, the overall numbers of any given taxon were quite low" (*Boyce et al. 2007*). The authors conclude that "additional, carefully controlled studies [of vector control activities] are needed to more fully understand the short- and long-term

impacts on nontarget species." Kwan et al. (*2009*) reported similar results in a study conducted in 2007, and concluded that a considerable number of small-bodied insects are killed as a result of a single application of ultra-low volume pyrethrins; however, the effect is short lived at the population level. Another study conducted at some seasonal ponds on the Sutter NWR found that although there was a decrease in the number of flying insects following application of adulticides, including pyrethrin, the numbers rebounded within 48 hours (*Jensen et al. 1999*). Although these studies looked at the effects of various adulticides, they did not include the use of phenothrin. However, phenothrin is a synthetic form of pyrethrin; therefore, the outcomes would be expected to be similar.

Although the application of ultra-low volume adulticides can result in the loss of significant numbers of non-target insects within and surrounding a treatment area, it appears from the literature that the effects would be localized and temporary in nature. The anticipated limited use of ultra-low volume adulticide application on the Refuge is expected to be very infrequent and use will be limited to specific locations and under specific meteorological conditions; all of which will further reduce the potential for significant adverse effects on terrestrial invertebrates.

Public Use

As no new public use opportunities are proposed under Alternative B, the effects to insects, reptiles, and amphibians would be the same as those described for Alternative A.

5.4.2.5 Effects to Mammals

Wildlife and Habitat Management

Under Alternative B, all of the actions described in Alternative A would also be implemented. Therefore, the effects to mammal as a result of implementing these specific actions, including predator management, would be the same as those described above for Alternative A.

Impacts to land mammals would be similar to those described for landbirds in that upland habitat would be converted to wetland and transitional habitat resulting in the loss of habitat to support upland oriented species. The mammalian species that occur on the Refuge also occur on the adjacent uplands of NWSSB, as well as along the edges of the marsh, therefore, some habitat to support these species will continue to be present on the Refuge. Because the population of mammals on the Refuge is small and no special status or sensitive species are supported exclusively on the Refuge, the loss of upland habitat would not represent a significant adverse impact to mammals.

Avoidance of significant adverse effects to seals and sea lions that occasionally enter the Refuge through the larger tidal channels that extend to Perimeter Pond and 7th Street Pond would occur through the implementation of measures similar to those described to protect sea turtles during construction and culvert replacement. These measures include conducting presence/absence surveys prior to construction, monitoring for these species during construction, and installing appropriate barriers, as appropriate, to keep these species out of the restoration areas during construction.

Pest Management

Implementation of the IPM Plan for the Refuge (Appendix C), as described above, would ensure that no adverse effects to the Refuge's mammals would occur as a result of the use of pesticides.

The pesticides proposed for use under this alternative to control mosquitoes are not expected to adversely affect mammalian species supported on the Refuge. Spinosad is relatively low in toxicity

to mammals (*Thompson et al. no date*), while no effects to mammals would be expected as a result of the use of Agnique MMF. Phenothrin (Anvil) is not known to be acutely toxic at high exposure levels to humans or mammals, but exhibits low acute toxicity by oral, dermal, and inhalation routes of exposure (*USEPA 2008b*). The data also indicates that piperonyl butoxide does not effectively act as a pyrethroid synergist in mammals.

Public Use

As no new public use opportunities are proposed under Alternative B, the effects to mammals would be the same as those described for Alternative A.

5.4.3 Alternative C (Proposed Action) – Optimize Upland/Wetland Restoration, Improve Opportunities for Wildlife Observation

5.4.3.1 Effects to Waterfowl, Seabirds, Shorebirds, and Other Waterbirds

Wildlife and Habitat Management

Management actions under Alternative C would be similar to those provided under Alternative B. The primary difference between the two alternatives involves the types of habitats that would be restored. Under Alternative C, there would be a greater mix of upland and wetland/upland transitional habitat restored than is proposed in Alternative B. Despite this difference, the effects to waterbirds of implementing the restoration proposals included under Alternative C would be generally the same as those described for Alternative B.

The proposal to improve the habitat quality within a portion of the Refuge's cordgrass-dominated salt marsh habitat would have a temporary adverse effect on waterbirds as a result of the disturbance and temporary loss of habitat from placing a thin layer of soil on top of the existing cordgrass vegetation. This activity would occur outside of the nesting season and outside of peak migration periods to minimize impacts to avian species present in the marsh. Only a small portion of the marsh would be impacted at any one time and cordgrass would be expected to grow up through the soil within several months, therefore, impacts would be short in duration and limited in area resulting in less than significant impacts to avian species. This activity is expected to improve habitat quality within cordgrass habitat resulting in benefits to a variety of marsh-dependent avian species.

The removal of the drop tower would eliminate a current great blue heron nesting site. In 2009, approximately three pair of herons nested on the drop tower and similar numbers of nesting pairs have used the tower over the last several years (*pers. comm. John Fitch, April 7, 2010*). Herons have also been observed nesting in the eucalyptus trees on NWSSB near the recreational vehicle park, located to the northwest of the Refuge, and on buoys in the outer portion of Anaheim Bay. The drop tower supports relatively few nesting herons compared to other known nesting sites in Orange County, including nesting sites at Anaheim Lake, where up to 50 nesting pairs have been observed and Irvine Lake where up to 40 nests have been observed (*Hamilton and Willick 1996*). Although the removal of the drop tower would displace nesting herons, the elimination of this nesting site would not represent a significant adverse impact to the regional population of nesting great blue herons. Other nesting opportunities are available in the area, including elsewhere on NWSSB, at Bolsa Chica, and in various locations in adjacent Huntington Beach and Long Beach.

Pest Management

The analysis of potential effects to waterfowl, seabirds, shorebirds, and other waterbirds from the implementation of the IPM and Mosquito Management Plans would be the same under this

alternative as described previously for Alternative B; however, the use of Natular is not proposed under this alternative.

Public Use

The visitor services opportunities described in Alternative A would continue to occur under Alternative C and additional opportunities for public use would also be provided, including increasing the number of days available annually for Refuge tours and/or bird watching events and constructing a two-level, 20-foot-high observation tower along the east side of Kitts Highway across from the Refuge visitor contact station. Although the number of tours and bird watching events would increase, the areas used to accommodate these activities would remain the same. As result, the potential for flushing waterbirds would remain relatively low and the frequency of disturbance would still be limited to just a few times a month. Therefore, the public use program proposed under Alternative C would not be expected to result in any significant adverse effects to waterfowl, seabirds, shorebirds, and other waterbirds.

5.4.3.2 Effects to Landbirds

Wildlife and Habitat Management

All of the actions described in Alternative A (e.g., predator management, invasive plant control, culvert maintenance and/or replacement, monitoring) and the majority of the actions described in Alternative B, with the exception of the specific restoration proposals, would also be implemented under Alternative C. Therefore, the effects of implementing these specific actions on landbirds would be similar to those described for Alternatives A and B.

The primary difference between Alternatives B and C with respect to landbirds is the proposal in Alternative C to restore native upland habitat near the northeast corner of the Case Road Pond and the southeast corner of the 7th Street Pond instead of wetland/upland transition habitat, as proposed under Alternative B. In total, approximately 36 acres of disturbed upland would be restored under Alternative C, with 11 acres to be restored to coastal sage scrub habitat (refer to Figure 3-5). The proposed restoration would eliminate much of the low-quality upland habitat present on the Refuge, which would displace landbirds during construction. This would represent a temporary adverse impact, but the impacts would not be considered significant because the numbers of landbirds affected would be low and no listed or special status species supported by upland habitat would be affected. The establishment of 11 acres of coastal sage scrub habitat on the Refuge would provide long-term benefits to landbirds, including raptors whose prey base would increase slightly as a result of the availability of new native upland habitat.

Although the removal of the drop tower near the 7th Street Pond would eliminate perching opportunities for raptors and other landbirds, this action would not represent a significant adverse effect to landbirds because there are numerous perching opportunities available for these birds just beyond the Refuge boundary. The actions associated with improving habitat quality within portions of the Refuge's cordgrass habitat would have no effect on landbirds.

Pest Management

The analysis of potential effects to landbirds from the implementation of the IPM and Mosquito Management Plans would be the same under this alternative as described previously for Alternative B; however, the use of Natular is not proposed under this alternative.

Public Use

Alternative C would expand available public use opportunities on the Refuge as described in Section 5.4.3.2; however, the level of disturbance to landbirds as a result of this limited increase in

public use would be less than significant. The observation platform would be constructed on disturbed habitat that only supports limited numbers of landbirds; therefore, no impacts to and birds are anticipated as a result of this proposal.

5.4.3.3 Effects to Fish and Other Marine Organisms

Wildlife and Habitat Management

The impacts to fish and other marine organisms as a result of implementing Alternative C would be similar to those described under Alternative B. All of the measures discussed in Section 5.4.2.3 to avoid significant adverse impacts to fish and other marine organisms would also be implemented under Alternative C. Benefits to fish and other marine organisms would be slightly lower than those provided under Alternative B, as approximately 11 acres of the proposed restoration area would be restored to upland rather than tidally influenced habitat under Alternative C.

Removal of the drop tower would have no effect on fish or other marine organisms, while the proposal to improve habitat quality within portions of the Refuge's cordgrass habitat could adversely affect marine organisms. To minimize the potential for impacts to fish and other marine organisms as a result of depositing a layer of clean material over portions of the Refuge's cordgrass habitat, silt fencing or other techniques for controlling sediment movement outside of the proposed enhancement area would be installed to reduce the potential for increased turbidity throughout the marsh. In addition, treatment areas would be limited in size to further reduce the effects of this activity on overall water quality within the Refuge.

Pest Management

The analysis of potential effects to fish and other marine organisms from the implementation of the IPM and Mosquito Management Plans would be essentially the same under this alternative as described previously for Alternative B. The exception is that the use of Natular is not proposed under this alternative, therefore, potential adverse effects to marine and estuarine organisms related to use of Natular would not occur.

Public Use

Expansion of the public use program and construction of an observation tower would have no effect on fish or other marine organisms.

5.4.3.4 Effects to Terrestrial Invertebrates, Amphibians, and Reptiles

Wildlife and Habitat Management

The impacts to terrestrial invertebrates, amphibians, and reptiles, particularly sea turtles, as a result of implementing Alternative C would be similar to those described under Alternative B. All of the measures discussed in Section 5.4.2.4 to avoid significant adverse impacts to sea turtles would also be implemented under Alternative C. As noted earlier, amphibians and reptiles are generally not well represented on the Refuge, and impacts to these organisms as a result of restoration would be minimal. Restoring approximately 36 acres of low quality upland habitat would reduce the area available to support terrestrial invertebrates, amphibians, and reptiles; however, the proposal to restore approximately 11 acres of high quality coastal sage scrub habitat would actually improve overall conditions on the Refuge for these species.

Under Alternative C, in addition to conducting directed surveys for tiger beetles, if possible, a tiger beetle management plan would be implemented that identifies measures for protecting, maintaining, and where necessary, enhancing habitat to protect current tiger beetle species abundance and diversity on the Refuge. Thus, Alternative C would be the most beneficial of the three alternatives for tiger beetles.

The removal of the drop tower and the proposal to enhance habitat quality in portions of the Refuge's cordgrass-dominated salt marsh habitat would have no effect on terrestrial invertebrates, amphibians, or reptiles.

Pest Management
The analysis of potential effects to terrestrial invertebrates, amphibians, and reptiles from the implementation of the IPM and Mosquito Management Plans would be the same under this alternative as described previously for Alternative B; however, the use of Natular is not proposed under this alternative.

Public Use
Expansion of the public use program and construction of an observation tower would have no effect on terrestrial invertebrates, amphibians, or reptiles.

5.4.3.5 Effects to Mammals

Wildlife and Habitat Management
Impacts to land mammals would be similar to those described for landbirds, in that disturbed upland habitat would be converted to wetland, transitional, and native upland habitat. This would result in the temporary loss of approximately 36 acres of upland habitat and the permanent loss of 26 acres of upland habitat. Because the population of mammals on the Refuge is small and no special status or sensitive species are supported exclusively on the Refuge, this loss of upland habitat would not represent a significant adverse impact to mammals.

Avoidance of significant adverse effects to seals and sea lions would occur through the implementation of measures similar to those described to protect sea turtles during construction and culvert replacement. These measures include conducting presence/absence surveys prior to construction, monitoring for these species during construction, and installing appropriate barriers, as appropriate, to keep these species out of the restoration areas during construction.

Pest Management
The analysis of potential effects to mammals from the implementation of the IPM and Mosquito Management Plans would be the same under this alternative as described previously for Alternative B however, the use of Natular is not proposed under this alternative.

Public Use
Expansion of the public use program and construction of an observation tower would have no effect on the limited number of mammals present within the Refuge.

5.5 Effects to Endangered and Threatened Species and Other Species of Concern

The direct, indirect, and cumulative effects to endangered and threatened species and other species of concern as a result of implementing the various alternatives are described below. An adverse effect to these species would be considered significant if:

- An action would result in the direct mortality or habitat loss, lowered reproductive success, or habitat fragmentation of a federally or state listed plant species.

- Permanent loss of occupied listed species habitat, substantial loss of foraging or nesting habitat for a listed or special status species, or the direct mortality of individuals of a listed species would occur as a result of a proposed action.

An indirect beneficial impact would occur if an action would result in the creation of substantial new areas of foraging, roosting, or nesting habitat for listed or special status wildlife species, or substantial new areas of habitat appropriate to support listed or special status plant species. A significant cumulative impact would result from habitat modifications affecting listed or special status species that would be considered minor for the proposed action but would be significant when considered in light of other similar losses within the region.

Information about the list species and other species of concern that are known to occur or have the potential to occur on the Refuge is provided in Chapter 4, Sections 4.3.5 – 4.3.7.

5.5.1 Alternative A – No Action

5.5.1.1 Effects to California Least Tern

Wildlife and Habitat Management

Management activities currently being implemented on the Refuge would continue under Alternative A. Those existing activities that could have a direct effect on the California least tern include annual maintenance of the least tern nesting site at NASA Island, including site preparation, invasive weed control, and fence repair; implementation of predator management; conducting the Eyes on the Colony volunteer program; monitoring of the least tern nesting colony throughout the nesting season; monthly bird surveys, and periodic night surveys. The majority of these activities are implemented to benefit the least tern nesting colony. Other activities associated with Refuge management such as trash and debris removal are scheduled to avoid sensitive locations during the nesting season, while major projects such as culvert maintenance or replacement would occur outside of the nesting seasons. These measures would avoid any potential impacts to nesting terns.

Temporary disturbance of nesting terns can occur when site monitors enter or get close to the nesting area. This disturbance can cause adult terns to momentarily leave the nest, putting chicks or eggs at risk of predation. To reduce the potential for disturbance, monitoring protocols, such as limiting the number and duration of visits to the nesting site, are implemented throughout the nesting season. Past experience has demonstrated that when these protocols are followed, the benefits of the data provided as a result of monitoring outweigh the minor temporary adverse effects that occur during monitoring.

On-site monitoring also facilitates timely adaptive management. If during monitoring it is determined that disturbance impacts are becoming a threat to the nesting terns, the existing protocols can be reevaluated and additional measures (e.g., greater use of blinds, further limiting the time spent in the colony, scheduling monitoring activities to avoid periods of increased disturbance from other sources, such as adverse weather conditions or the presence of potential predators) can be implemented. Another benefit of monitoring is the ability to quickly respond to any signs of potential predation, thus avoiding any loss of adult terns, chicks, or eggs.

Depredation of California least terns by mammalian and avian predators was the primary limiting factor to the reproductive success of this species throughout its range in 2000, however in 2008, overall least tern mortality due to non-predation factors was greater than mortality due to predation (*Marschalek 2009*). At Seal Beach NWR in 2008, an estimated 206 nests were

established on NASA Island, but only 44 fledglings were produced. It is believed that great blue heron predation was responsible for the high levels of mortality at this site. The implementation of predator management on the Refuge is intended to benefit the least tern by reducing mortality in the tern nesting colony through the control of potential predators before they enter the site. Unfortunately, this is not always possible and predators do find access into the site. For mammalian predators, this often occurs at night, while avian predation can occur at any time. The predator management program as currently implemented does not result in any adverse impacts to the nesting terns, but does provide important benefits. The overall effectiveness of the program could be improved by enhancing visual access into the nesting area for the Eyes on the Colony volunteers.

An issue that may arise in the near future is the predation of young least tern chicks by gull-billed terns, a Bird of Conservation Concern. Predation of least tern chicks by gull-billed terns has been repeatedly documented in San Diego County and at least one account of predation by a gull-billed tern was recorded in Orange County during the 2009 nesting season. A pair of gull-billed terns was observed picking up two least tern chicks on NASA Island in June 2009, but for unknown reasons, the chicks were dropped and the gull-billed terns ultimately left the site. The current predator management plan for the Refuge does not address specific measures for controlling gull-billed terns either directly or indirectly, therefore, adverse effects to least terns as a result of gull-billed tern predation could occur in the future. The Service is currently meeting to develop management solutions for the benefit both species. Depending upon the types of solutions approved to address this issue, amendments to the existing predator management plan for Seal Beach NWR could be proposed at some time in the future. Substantive changes or additions to the way in which predator management is implemented on the Refuge would require additional NEPA compliance prior to the approval of the revised plan.

Pest Management

Herbicides are used on NASA Island to control invasive, weedy species. Applications within the nesting site are conducted outside of the nesting season when the terns are not present on the Refuge. Products that have been used in this area include Surflan AS, Glyphosate Pro 4, and Aquamaster. Surflan AS is an effective pre-emergent that has reduced the need for extensive annual control of weedy species. Glyphosate Pro 4 and Aquamaster are currently used for spot treatment of weedy plants on the nesting site. USEPA has determined that oryzalin, the active ingredient in Surflan, may be characterized as "slightly toxic" to birds in acute studies and "practically non-toxic" in dietary studies (*USEPA 1994*). Glyphosate is described by the USEPA as “no more than slightly toxic to birds” (*USEPA 1993*).

No mosquito monitoring or control is implemented on NASA Island or in the primary foraging areas around the nesting island, therefore, no adverse effects to terns as a result of mosquito control would be anticipated.

Public Use

No public use activities are permitted in the immediately vicinity of NASA Island during the nesting season, therefore, no impacts to nesting terns are anticipated as a result of continuing the current public use program on the Refuge. Volunteer activities including clean-up and weed pulling on NASA Island occurs annually just prior to the commencement of nesting season. This public use activity represents a benefit to the nesting terns.

5.5.1.2 Effects to Light-footed Clapper Rail

Wildlife and Habitat Management

Current management activities conducted on the Refuge to protect and assist in the recovery of the light-footed clapper rail include pre-season nesting platform maintenance and replacement, monitoring during the nesting season, annual population estimates, occasional release of captive-bred rails into the marsh, and implementing predator management. All of these activities, which would continue under Alternative A, could result in potential adverse effects on the light-footed clapper rail. Additional activities conducted on the Refuge that could affect rails include: conducting monthly bird surveys; inspecting, removing trash and debris from the marsh; and maintaining and replacing culverts. To avoid impacts to nesting rails, all of these activities with the exception of nesting season monitoring, predator management, and monthly bird surveys would be conducted outside of the nesting season. This measure avoids the potential for disturbance-related impacts to rail fledgling success.

Outside of the breeding season, all activities that require access into the marsh are conducted in a manner that would avoid any direct impacts to rails, as well as minimize the potential for indirect impacts related to disturbance of individual rails and/or native marsh vegetation. Although most activities implemented on the Refuge occur on the edges of the marsh, some activities, such as the inspection or replacement of nesting platforms or conducting rail counts, require access into sensitive marsh habitat. To minimize disturbance to rails and vegetation, access into these areas is often obtain through the use of non-motorized boats, primarily canoes. The protocols followed when working in rail habitat have been established to ensure that no significant adverse impacts to rails would occur as a result of Refuge management activities.

Pest Management

Little, if any, herbicide application occurs in or near known light-footed clapper rail habitat, therefore, impacts related to disturbance and indirect impacts from the chemicals themselves would not be anticipated. Indirect impacts are also minimized by only applying herbicides in accordance with the product label.

The SUP issued each year to the OCVCD for mosquito management on the Refuge prohibits access into sensitive light-footed clapper rail habitat, therefore, impacts related to disturbance and indirect impacts from the mosquito control products currently used on the Refuge are not anticipated.

Public Use

No public use activities are permitted within the marsh; therefore, no impacts to the light-footed clapper rail are anticipated as a result of continuing the current public use program on the Refuge.

5.5.1.3 Effects to Western Snowy Plover

Wildlife and Habitat Management

The western snowy plover does not nest on the Refuge and is only observed on the Refuge in small numbers during the winter months. Other than general management of the coastal wetlands within the Refuge to benefit migratory birds, no programs or actions are implemented on this Refuge specifically to benefit the western snowy plover. This would remain the case under Alternative A. The potential effects to the western snowy plover of implementing Alternative A would be the same as those described for waterbirds in Section 5.4.1.1.

Pest Management
Herbicide treatment does not occur in proximity to potential western snowy plover foraging habitat and mosquito control does not occur during the time that plovers would be likely to occur on the Refuge, therefore, no adverse effects to plovers would result from the implementation of pest management on the Refuge under this alternative.

Public Use
The potential effects to the western snowy plover of continuing to implement the existing public use program on the Refuge would be the same as those described for waterbirds in Section 5.4.1.1.

5.5.1.4 Effects to Salt Marsh Bird's-Beak

Wildlife and Habitat Management
Salt marsh bird's-beak is not currently known to occur on the Refuge; however, there are historic accounts of its presence around Anaheim Bay. Several unsuccessful attempts have been made in the past to establish a population of this species on the Refuge. Alternative A would not renew these attempts; therefore, this alternative would neither benefit nor impact this listed species.

Pest Management
Salt marsh bird's-beak is not currently known to occur on the Refuge and Alternative A would not renew attempts to establish this species on the Refuge; therefore, no effects to this species would result from ongoing pest management.

Public Use
Salt marsh bird's-beak is not currently known to occur on the Refuge; therefore, no adverse or beneficial effects to salt marsh bird's-beak would result from the public use program carried out under Alternative A.

5.5.1.5 Effects to Eastern Pacific Green Turtle

Wildlife and Habitat Management
Eastern Pacific green turtles have been observed in the 7th Street Pond as well as the channel leading to the 7th Street Pond, therefore, any enhancement work or culvert replacement projects proposed in this area, as well as throughout the Refuge, could adversely affect this species if appropriate measures are not implemented to ensure their safety. Measures that would protect turtles present on the Refuge would include: conducting a presence/absence survey for turtles prior to and during any proposed construction, using impingement barrier structures, rock filters, or other types of exclusion structures around temporary water intake structures to prevent turtle entrainment, prohibiting the placement of any materials into subtidal habitat that have the potential for entangling sea turtles, and considering potential turtle movement in the design and sizing of culverts and water control structures. The incorporation of these measures into future construction project specifications would avoid any adverse effects to sea turtles.

Pest Management
Activities associated with invasive plant control and mosquito management would not be expected to adversely affect the sea turtles that are occasionally present on the Refuge, provided all pesticides are applied in accordance with label requirements.

Public Use
The public uses permitted on the Refuge under Alternative A are restricted to the roads and pathway that traverse the upland areas surrounding the Refuge's sensitive wetland areas. The open water areas of the Refuge where sea turtles have been observed are closed to any public use,

therefore, the potential for disturbance from the public is minimal and there is no potential for direct impacts related to public use on the Refuge. Therefore, no adverse effects to sea turtles would result from the public use program carried out under Alternative A.

5.5.1.6 Effects to Belding's Savannah Sparrow

Wildlife and Habitat Management

Belding's savannah sparrows occur year-round on the Refuge. Under Alternative A, continuing management actions to support the State endangered Belding's savannah sparrow would include limiting human disturbance within Belding's savannah sparrow habitat, particularly during the nesting season, and accommodating the State-wide Belding's savannah sparrow survey that is conducted approximately every five years. The potential effects to this species of implementing Alternative A would be similar to those described for waterbirds in Section 5.4.1.1.

Pest Management

Human activity associated with mosquito management could result in disturbance to Belding's savannah sparrow, which occur along the upper edges of the marsh and within the wetland/upland transition areas. To minimize disturbance to this species, mosquito monitoring and control is limited to specific locations on the Refuge (see Chapter 3) and within those locations, all activity must be conducted on foot. Specifics regarding where and how access can occur in and around the marsh is provided in detail in the SUP that is prepared annually for this use. No significant adverse effects to this species are anticipated as a result of continuing the current mosquito control practices on the Refuge.

Public Use

Activities associated with the existing limited public use program which includes Refuge tours and bird watching opportunities is generally confined to the existing streets and pathways within the Refuge. Further, in most cases, these streets and pathways extend around large areas of salt marsh rather than through the marsh. Considering the limited human presence on the Refuge (i.e., approximately two to three events per month) and the separation of that limited human activity from high quality Belding's savannah sparrow habitat, the levels of disturbance that could affect this species are low and do not represent a significant adverse effect.

5.5.2 Alternative B – Maximize Salt Marsh Restoration, Continue Current Public Uses

5.5.2.1 Effects to California Least Tern

Wildlife and Habitat Management

In addition to those steps and measures undertaken on behalf of the California least tern under Alternative A, under Alternative B the Refuge Manager would work with the Navy to reduce perching opportunities for raptors around the marsh. Potential actions could range from installing anti-perching materials on existing power poles and rooftops to relocating the existing poles well away from the marsh. Because several of the raptor species observed on NWSSB are known to prey on least tern adults and chicks, eliminating potential perching sites could reduce the incidence of avian predation and disturbance in the least tern colony, representing a benefit to least terns. Other activities proposed under Alternative B such as removal of concrete and debris from the marsh and installing a new water control structure to improve water circulation in the Bolsa Cell would be implemented during the non-breeding season, therefore, these activities would have no effect on least terns. In addition, the implementation of a water quality monitoring program would have no effect on least terns, as monitoring stations would be established away from sensitive nesting and foraging areas.

Pest Management

Implementation of an IPM program, which is designed to minimize the potential for impacts to Refuge resources, would have effects similar to those described for waterbirds in Section 5.4.2.1. The Mosquito Management Plan prepared for the Refuge provides a phased approach to mosquito control and monitoring and continues to endorse the existing access limitations that are currently included in annual SUPs issued to the OCVCD. Therefore, no adverse effects to the least tern are anticipated as a result of mosquito monitoring and control in accordance with the Mosquito Management Plan.

Public Use

The potential effects to least terns of implementing public use proposals as described in Alternative B would be the same as those described for waterbirds in Section 5.4.1.1.

5.5.2.2 Effects to Light-footed Clapper Rail

Wildlife and Habitat Management

In addition to those actions to be undertaken on behalf of the light-footed clapper rail under Alternative A, under Alternative B the Refuge Manager would work with the Navy to reduce perching opportunities for raptors around the marsh, as well as work with researchers and others to develop a better understanding of the habitat qualities and species dynamics of the natural rail nesting areas located between Hog Island and Perimeter Pond. Efforts will be made to identify those factors that may favor natural nesting in this area; to compare fledgling success rates for natural areas versus nesting platforms; and to determine what options might be available for improving nesting habitat quality for rails in other parts of the marsh. All of these actions could result in benefits for the rail population on the Refuge.

Among the other actions proposed under Alternative B that could benefit the rail is the installation of a water control structure in the Bolsa Cell levee. This water structure would allow the water levels in the Bolsa Cell to be adjusted to maintain tidal elevations in portions of the cell at levels optimal for supporting cordgrass habitat. The tide gate could also be adjusted in the future in response to sea level rise. Proposals to restore additional salt marsh habitat on the Refuge could also benefit rails once the habitat is established.

The construction of the water control structure, removal of concrete and debris from the marsh, and restoration adjacent to rail habitat could result in temporary adverse impacts to the rail. To minimize the potential direct and indirect effects of construction on the rail, various measures would be incorporated into the scope of work including prohibiting any construction during the nesting season, conducting presence/absence surveys for rails in construction areas that could support rails, and providing temporary fencing of the construction site perimeter to discourage rails from entering the site and keeping construction equipment out of sensitive habitat. The implementation of these measures would reduce the potential for adverse effects to rails.

Pest Management

The potential effects to light-footed clapper rails of implementing the IPM and Mosquito Monitoring Plans would be essentially the same as those described for waterbirds in Section 5.4.2.1. In addition, if the application of an adulticide is required due to a declared public health emergency, the SUP would be amended prior to application to include additional conditions intended to ensure that no adverse effects to the Refuge's clapper rail population would occur.

Public Use

The potential effects to light-footed clapper rails of implementing public use proposals as described in Alternative B would be the same as those described for waterbirds in Section 5.4.1.1.

5.5.2.3 Effects to Western Snowy Plover

Wildlife and Habitat Management

The western snowy plover does not nest on the Refuge and is only observed on the Refuge in small numbers during the winter months. Other than general management of the coastal wetlands within the Refuge to benefit migratory birds, Alternative B does not include any programs or actions intended specifically for the benefit the western snowy plover. The potential effects to the western snowy plover of implementing Alternative B would be the same as those described for waterbirds in Section 5.4.2.1.

Pest Management

The potential effects to the western snowy plover of implementing the pest management proposals described in Alternative B would be the same as those described in Section 5.5.1.3.

Public Use

The potential effects to western snowy plovers of implementing public use proposals as described in Alternative B would be the same as those described for waterbirds in Section 5.4.1.1.

5.5.2.4 Effects to Salt Marsh Bird's-Beak

Wildlife and Habitat Management

Salt marsh bird's-beak does not presently occur on the Refuge; however unsuccessful attempts to establish it here have been made in recent decades. Alternative B does not propose to renew these attempts; therefore, the implementation of Alternative B would have no effect on this listed species.

Pest Management

Salt marsh bird's-beak is not currently known to occur on the Refuge and Alternative B would not renew attempts to establish this species on the Refuge; therefore, no effects to this species would result from ongoing pest management.

Public Use

Salt marsh bird's-beak is not currently present on the Refuge and no attempts to reestablish it on the Refuge are proposed under this alternative, therefore, no adverse or beneficial effects to salt marsh bird's-beak would result from the public use program carried out under Alternative B.

5.5.2.5 Effects to Eastern Pacific Green Turtle

Wildlife and Habitat Management

Incorporation of the measures described in Section 5.5.1.5 into the scope of the restoration and enhancement projects proposed under Alternative B would minimize the potential for impacts to sea turtles.

Pest Management

Implementation of the BMPs included in the IPM and Mosquito Management Plans would minimize the potential for impacts to sea turtles.

Public Use
No adverse or beneficial effects to Pacific green sea turtle would result from the public use program carried out under Alternative B.

5.5.2.6 Effects to Belding's Savannah Sparrow

Wildlife and Habitat Management
Under Alternative B, management actions such as limiting human disturbance in and around the marsh, particularly during the nesting season, and accommodating the State-wide Belding's savannah sparrow survey, would continue. These actions provide direct and indirect benefits to the State endangered Belding's savannah sparrow, and would not result in any significant adverse effects to this species (refer to Section 5.5.1.5 above).

Other actions included in Alternative B, such as construction of the water control structure in the Bolsa Cell levee, the removal of concrete and debris from the marsh, species monitoring, and the restoration of various areas throughout the Refuge could result in temporary adverse impacts to this species. To minimize the potential direct and indirect effects of construction on Belding's savannah sparrows, various measures would be incorporated into the scope of work including prohibiting any construction during the nesting season and protecting sensitive salt marsh habitat adjacent to construction sites from temporary direct or indirect effects of construction by clearly delineating construction boundaries and monitoring construction activities throughout the duration of the project. In addition, time spent conducting monitoring and other activities in sensitive habitat areas would be limited to reduce the disturbance levels that could be associated with monitoring. The implementation of these measures would reduce the potential for adverse effects to Belding's savannah sparrows as a result of construction activities to below a level of significance.

Replacement of the existing culverts at the west end of the Bolsa Cell with a water control structure is expected to eliminate the fluctuations in tidal flow into the Cell that over the years have resulted in excessively high or low water levels and degraded water quality. This will in turn provide more consistent conditions in the Cell for supporting habitat preferred by the Belding's savannah sparrow. Based on previous modeling results (*Sea Dyn, Inc. 1993*), the higher high water and lower low water levels in the Bolsa Cell are directly influenced by the tidal regime in the mitigation channel. Therefore, the higher high water levels in the Bolsa Cell could achieve levels similar to those experienced in the Cell prior to the Port of Long Beach restoration project, while the lower low water levels would be approximately 0.3 feet higher than pre-restoration levels. The water control structure would therefore be used primarily to control the higher high tide levels in the cell, and these water levels would be regulated to optimize habitat for a range of wetland dependent species, including the Belding's savannah sparrow. The water control structure would also allow for adjustments in response to sea level rise.

Alternative B proposes to regulate water levels in the Bolsa Cell, as well as restore approximately 15 acres of coastal salt marsh. These proposals would benefit the Belding's savannah sparrow.

Pest Management
Herbicide treatments are generally limited to areas of disturbed weedy upland vegetation; therefore, impacts to Belding's savannah sparrow and its habitat are not anticipated. The implementation of the BMPs included in the IPM Plan for the Refuge would ensure that pesticides used during invasive plant control does not enter or drift over into occupied salt marsh habitat.

Potential effects to Belding's savannah sparrow as a result of mosquito management would be minimized through adherence to the conditions related to access included in the annual SUP issued

to the OCVCD, as well as compliance with the BMPs included in the Mosquito Management Plan. The potential for impacts related to specific control products used or proposed for use on the Refuge would be the same as those described in Sections 5.4.2.1 and 5.4.2.2.

Public Use

The effects of continuing the existing public use program, as proposed under Alternative B, would result in the same effects as described under Section 5.5.1.5.

5.5.3 Alternative C (Proposed Action) – Optimize Upland/Wetland Restoration, Improve Opportunities for Wildlife Observation

5.5.3.1 Effects to California Least Tern

Wildlife and Habitat Management

The effects to the California least tern of implementing the actions described in Alternatives A and B would also be realized under Alternative C. Of the additional actions proposed under Alternative C, only the proposal to remove the drop tower would have an effect on the California least tern. Removal of the drop tower located at the end of 7th Street would eliminate a significant avian predator perching spot. The drop tower is currently used by raptors, corvids, and great blue herons, all of which are known to prey on least tern adults, chicks, and/or eggs. Therefore, the removal of this tower would represent a benefit to the tern colony. Removal of the drop tower would occur outside of the breeding season to avoid any direct or indirect impacts to nesting least terns as a result of demolition. The differences in proposed habitat restoration between Alternatives B and C would have no effect on the least tern colony.

Pest Management

The analysis of potential effects to the California least tern from the implementation of the IPM and Mosquito Management Plans would be the same under this alternative as described previously for Alternative B.

Public Use

The limited increase in public use activities on the Refuge, as proposed under Alternative C, would have no effect on California least terns, as no public access is permitted in proximity to NASA Island during the tern nesting season. The elevated observation platform would be located a sufficient distance from the nesting colony to prevent its use as an avian predator perch and would therefore have no effect on least terns.

5.5.3.2 Effects to Light-footed Clapper Rail

Wildlife and Habitat Management

The effects to the light-footed clapper rail of implementing the actions described in Alternatives A and B would also be realized under Alternative C. Of the additional actions proposed under Alternative C, the proposals to remove the drop tower and to study and implement actions to improve the quality of the cordgrass-dominated salt marsh habitat on the Refuge would have an effect on the light-footed clapper rail. Removal of the drop tower, which sits at the edge of the marsh, would eliminate a substantial perching structure, where avian predators known to prey on adult rails and chicks have been observed. The removal of this structure is therefore likely to benefit rails. Removal of the drop tower would occur outside of the breeding season to avoid any direct or indirect impacts to nesting rails as a result of demolition.

Proposals to better understand the natural nesting habitat requirements of the clapper rail and subsequent actions to improve habitat quality for the clapper rail are expected to benefit the rail population. However, measures will also be taken during the implementation of studies in the marsh to ensure that the Refuge's rail population is not subject to any significant adverse direct or indirect impacts. Disturbance during the nesting season to study nesting rails will be minimized to the maximum extent practicable and actions to improve habitat quality would only be implemented outside of the nesting season.

The effects to the clapper rail from the restoration proposals under Alternative C (more wetland/upland transitional habitat for refugia during higher high tides) would be different from those provided in Alternative B (more salt marsh habitat for foraging and/or nesting), but both would provide benefits to the rail following establishment.

Pest Management

The analysis of potential effects to the light-footed clapper rail from the implementation of the IPM and Mosquito Management Plans would be the same under this alternative as described previously for Alternative B.

Public Use

No public use activities are permitted within the marsh; therefore, no impacts to the light-footed clapper rail are anticipated as a result of the limited increase in public use proposed under Alternative C.

5.5.3.3 Effects to Western Snowy Plover

Wildlife and Habitat Management

The western snowy plover does not nest on the Refuge and is only observed on the Refuge in small numbers during the winter months. Other than general management of the coastal wetlands within the Refuge to benefit migratory birds, Alternative C does not include any programs or actions intended specifically for the benefit the western snowy plover. The potential effects to the western snowy plover of implementing Alternative C would be the same as those described for waterbirds in Section 5.4.3.1.

Pest Management

The analysis of potential effects to the western snowy plover from the implementation of the IPM and Mosquito Management Plans would be the same under this alternative as described previously for Alternative B.

Public Use

The visitor services opportunities described in Alternative A would continue to occur under Alternative C and additional opportunities for public use would also be provided, including increasing the number of days available annually for Refuge tours and/or bird watching events and constructing a two-level, 20-foot-high observation tower along the east side of Kitts Highway across from the Refuge visitor contact station. Although the number of tours and bird watching events would increase, the areas used to accommodate these activities would remain the same. As result, the potential for flushing shorebirds, including wintering western snowy plovers, would remain relatively low and the frequency of disturbance would still be limited to just a few times a month. Therefore, public use program proposed under Alternative C would not be expected to result in any significant adverse effects to western snowy plovers.

5.5.3.4 Effects to Salt Marsh Bird's-Beak

Wildlife and Habitat Management

Under Alternative C, potential sites for the establishment of one or more populations of the salt marsh bird's-beak would be evaluated during the development of restoration plans for the area north of Case Road Pond, as well as for the area along the western edge of the Refuge. If appropriate locations are identified in one or both of these areas, actions to establish salt marsh bird's-beak would be initiated. The site would then be monitored for successful germination and plant development. If seeding is successful and plants produce flowers and set seeds, the site would be monitored annually to record the size and quality of the population at each site. Establishment of salt marsh bird's-beak at this location would represent a benefit to the species.

Pest Management

Herbicides, such as oryzalin (*USEPA 1994*), that have an acute risk to non-target plants, including threatened and endangered plants, would not be applied in proximity to any where attempts are being made to reestablish salt marsh bird's-beak. Additionally, implementation of the BMPs included in the IPM Plan would reduce the potential for unintended impacts to this species as a result of herbicide use on the Refuge.

If salt marsh bird's-beak is reestablished on the Refuge, the SUP prepared for annual mosquito monitoring and control would prohibit access to those areas where salt marsh bird's-beak is present. This would avoid any potential direct impacts to the species.

Public Use

Currently, no salt marsh bird's-beak is present on the Refuge; therefore, no adverse or beneficial effects to this species would result from the expanded public use program proposed under Alternative C. If establishment of this species on the Refuge is successful, appropriate measures would be implemented to keep the public out of areas where these plants are present.

5.5.3.5 Effects to Eastern Pacific Green Turtles

Wildlife and Habitat Management

Incorporation of the measures described in Section 5.5.1.5 into the scope of the restoration and enhancement projects proposed under Alternative C would minimize the potential for impacts to sea turtles.

Pest Management

Implementation of the BMPs included in the IPM and Mosquito Management Plans would minimize the potential for impacts to sea turtles.

Public Use

No adverse or beneficial effects to Pacific green sea turtle would result from the public use program carried out under Alternative B.

5.5.3.6 Effects to Belding's Savannah Sparrow

Wildlife and Habitat Management

The effects to the Belding's savannah sparrow of implementing the actions described in Alternatives A and B would also be realized under Alternative C. Implementation of actions to protect other species, such as removing the drop tower and improving the quality of the cordgrass habitat on the Refuge, would occur outside of the breeding season and would be implemented in a manner that would minimize impacts to existing native habitat. No significant adverse effects to the Belding's savannah sparrow are anticipated as a result of implementing these actions.

Pest Management

The analysis of potential effects to the Belding's savannah sparrow from the implementation of the IPM and Mosquito Management Plans would be the same under this alternative as described previously for Alternative B.

Public Use

Recent research on the effects of disturbance on Belding's savannah sparrow indicates that overall tolerance of human disturbance varies depending upon the level of disturbance occurring in a given area, as well as between seasons (*Fernández-Juricic et al. 2009*).

In areas where there are little if any public use activities, alert and flight responses to human approaches were observed to be greater than those observed in higher use areas. Suggested reasons for this difference in response includes: habituation (birds become accustomed to some level of human disturbance) and, 2) existing vegetative structure (higher vegetation seems to screen approaching humans, some human activity can be closer before a bird takes flight). On the Refuge, the vegetation in the wetland/upland transition areas adjacent to Belding's savannah sparrow habitat is generally low, therefore, disturbance adjacent to remote areas of the Refuge would likely result in a trend for alert distance (the distance at which the bird becomes alert and flees the area) and flight distance (the distance fled) to be greater than in areas where human activity is slightly higher and/or the vegetation between the human use and the marsh is higher. There also appears to be a trend for greater alert distance and flight distance in the non-breeding season (*Fernández-Juricic et al. 2009*).

Public tours of the Refuge are conducted along an established route that directs people around the marsh, not through the marsh; therefore, the potential for disturbance to Belding's savannah sparrows is low. Increasing the number of tours permitted on the Refuge would not substantially change the overall effects of tours on Refuge resources, including the Belding's savannah sparrow. The proposed observation tower would be located in a disturbed area where no impacts to Belding's savannah sparrows are anticipated.

If changes in the tour routes are considered, the design of the route should take into consideration the recommendation that a setback of approximately 210 feet be provided between the public use area and existing breeding territories and/or areas frequently used by the Belding's savannah sparrow during the non-breeding season (*Fernández-Juricic et al. 2009*). With the implementation of these measures, no adverse or beneficial effects to the Belding's savannah sparrow would result from the expanded public use program proposed under Alternative C.

5.6 Effects to Cultural Resources

The National Historic Preservation Act (NHPA) of 1966, as amended, establishes the federal government's policy on historic preservation and the programs through which that policy is implemented. Relevant policies on historic preservation and associated programs, including the National Register of Historic Places (NRHP), were described previously in Section 4.4.1. According to the NHPA, historic properties include "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places" (16 USC 470w(5)). The criteria used to evaluate eligibility are presented in Section 4.4.1 of this document.

Section 106 (16 USC 470f) of the NHPA requires federal agencies, prior to taking action, to take into account the effects of their undertaking on historic properties. Specific regulations regarding compliance with Section 106 state that although the tasks necessary to comply with Section 106 may be delegated to others, the federal agency is ultimately responsible for ensuring that the process is completed according to statute. The four steps in the Section 106 process are:

- Identify and evaluate historic properties;
- Assess adverse effects of the project on historic properties;
- Resolve any adverse effects of the project on historic properties in consultation with the SHPO/Tribal Historic Preservation Officer (THPO), and other interested parties, resulting in a Memorandum of Agreement (MOA); and
- Proceed in accordance with the MOA.

To determine if a proposed action could impact a cultural resource, it is necessary to conduct a survey of the Area of Potential Effects (APE) or if a survey has been previously conducted, to review the results of that survey and determine if any resources identified are eligible for inclusion in the NRHP. The APE is defined as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties. It is not necessary to know that the area in question contains historic properties, or even to suspect that such properties exist, in order to determine the APE. The APE is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking. In addition, the APE is not always a contiguous area; there may be multiple alternative project sites or multiple areas in which changes are anticipated.

A number of actions on the ground are proposed to implement the CCP. Each action would have its own project-specific APE. For example, the APE for the restoration of salt marsh in several locations under Alternatives B and C would include those areas proposed for restoration. As described in Section 4.4.3 and shown in Figure 4-18, investigations, surveys and research have previously been conducted for various portions of the APE and cultural resources have been identified. By 1992, the majority of NWSSB had been surveyed, including all of the areas of dry land within the boundaries of the Refuge. One of the sites recorded during these surveys, CA-ORA-298, is located within the Refuge boundary. This site has been determined to be eligible for listing on the NRHP because the site is likely to yield information regarding coastal adaptation and settlement during the Late Prehistoric Period.

The Refuge's coastal wetland areas remain unsurveyed due to inaccessibility. The potential for archaeological resources to be present in the existing wetlands is low because these areas were also covered with water during the prehistoric occupation period. There is also the potential for yet undiscovered buried deposits to be present within the previously surveyed low-elevation dry areas within the Refuge. Surveys of these areas and determinations of eligibility for any features that have not yet been evaluated would be required prior to the implementation of any ground-disturbing or other activities that may affect historic resources.

An impact to cultural resources would be considered significant if it adversely affects a resource listed in or eligible for listing in the NRHP. In general, an adverse effect may occur if a cultural resource would be physically damaged or altered, isolated from the context considered significant, affected by project elements that would be out of character with the significant property or its setting. Title 36 CFR Part 800 defines effects and adverse effects on historic resources as follows:

Section 800.5(1) Criteria of Adverse Effects. An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the NRHP in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the NRHP. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.

Section 800.5(2) Examples of Adverse Effects. Adverse effects on historic properties include, but are not limited to:

(i) Physical destruction, damage, or alteration of all or part of the property;
(ii) Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation and provision of handicapped access, that is not consistent with the Secretary's Standards for the Treatment of Historic Properties (36 CFR part 68) and applicable guidelines;
(iii) Removal of the property from its historic location;
(iv) Change of the character of the property's use or of physical features within the property's setting that contributes to its historic significance;
(v) Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features;
(vi) Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and
(vii) Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

Cumulative impacts to cultural resources could result from individually minor but collectively significant actions taking place over a period of time. Cumulative effects often occur to districts, where several minor changes to contributing properties, their landscaping,

5.6.1 Alternative A – No Action

Wildlife and Habitat Management

It is the policy of the NWRS to identify, protect, and manage cultural resources located on Service lands and affected by Service undertakings for the benefit of present and future generations. The Navy, as the landowner, also has responsibilities for insuring the protection of cultural resources within the Refuge.

In accordance with its responsibilities, the Navy has initiated cultural resource surveys for various projects on NWSSB and as a result, all of the areas within the Refuge that are accessible have been surveyed for archaeological resources. These surveys resulted in the identification of one site (CA-ORA-298) within the Refuge boundary and several sites located on the adjacent NWS in proximity to the Refuge. The site located on the Refuge was previously tested and following evaluation was determined to be eligible for listing on the NRHP. Routine maintenance and monitoring activities, particularly when conducted with motorized vehicles, could adversely affect the site. The surface of the site has been subject to disturbance for decades, yet the integrity

around the perimeter of the knoll is intact. A dirt road and turnabout on the top of the knoll are used periodically by the Refuge and Navy personnel, but the area is otherwise off-limits to the public. Because of the site's research potential, the current use of the road is being monitored for effects. It is recommended that if damage to the site is eminent, the site be protected or capped to prevent deterioration. The Service and Navy will coordinate the preservation efforts. Changes in the use of the area or the proposed preservation techniques will be assessed for effects in accordance with the regulations of the NHPA.

The Refuge's inaccessible wetlands have not been surveyed and although there is a potential for archaeological resources to be present, this potential is low because these areas were also covered with water during the prehistoric occupation period. There is also the potential for yet undiscovered buried deposits to be present within the previous surveyed low elevation dry areas within the Refuge. Therefore, any ground-disturbing activities proposed within the Refuge boundary – either to accommodate wildlife and habitat management or public use – must be reviewed in accordance with Section 106 and the procedures established by the Service's Cultural Resources Program to ensure that no adverse effects to known or unknown cultural resources occur as a result of Refuge activities.

The existing wildlife and habitat management activities implemented on the Refuge have limited or no potential for subsurface disturbance. For those activities that could result in ground disturbance, such as culvert replacement, the specific proposal is reviewed by the Service's Cultural Resources Program prior to implementation to ensure compliance with Section 106. The continuing to follow these established procedures would avoid any adverse impacts to cultural resources.

Public Use

The potential for ground disturbing activities to occur in association with the Refuge's limited public use program is limited; therefore, no adverse effects to cultural resources are anticipated as a result of continuing the current public use program as proposed under Alternative A. Refuge staff will continue to work with the Navy to assess potential effects to CA-ORA-298 as a result of conducting special bird watching outings on the Refuge. If damage to the site is eminent, the site would be protected or capped to prevent deterioration. The Service and Navy will coordinate the preservation efforts.

5.6.2 Alternative B – Maximize Salt Marsh Restoration, Continue Current Public Uses

Wildlife and Habitat Management

All of the areas proposed for restoration have been previously surveyed and no cultural resources have been encountered. However, because two sites (P-30-001503 and P-30-001504) located on a low elevation dry area of NWSSB were found to contain buried archaeological deposits during excavation, low elevation dry areas within the Refuge may also have undiscovered buried deposits (*Underwood and Cleland 2002*). To avoid adverse effects to cultural resources, a map indicating the APE of all restoration projects along with a detailed project description would be submitted for review to the Service's Cultural Resources Program, as well as appropriate Navy cultural resources staff, prior to finalizing any proposed restoration plans. Based on this information, Service and Navy staff will determine the appropriate measures to be implemented to protect cultural resources. It is anticipated that the following measure would apply to all of the restoration projects proposed under this alternative:

An archaeological monitor, meeting the Secretary of the Interior's Guidelines, would be present during ground-disturbing activities in areas of sensitivity for archaeological resources. These areas include any dry section within the Refuge, as well as previously undisturbed wetland areas and any areas located in proximity to previously identified sites (e.g., CA-ORA-1463, CA-ORA-1455, P-30-001503, P-30-001504) whether they occur on the Refuge or on the adjacent NWS.

If any cultural resources are discovered during excavation, all earthwork on the site would be halted and the Regional Historic Preservation Officer would be contacted to review the materials and recommend a treatment that is consistent with applicable laws and policies. The treatment plan would likely require the boundaries of the site to be defined before excavation can be reinitiated in an area well away from the discovered resource. The site would also be recorded and evaluated for eligibility to the NRHP. Once this work is completed, additional measures may be required depending upon the results of the eligibility determination. If any site is encountered that is determined to be eligible to the NRHP, the Service would consult with SHPO, federally recognized Tribes, and interested parties. Implementation of the procedures described above is expected to avoid adverse effects to cultural resources.

To identify and preserve traditional cultural properties and sacred sites and to determine the level of confidentiality necessary to protect them, the Refuge would work with interested tribal groups to establish government-to-government relationships that would ensure meaningful consultation with tribal governments during the planning phase of projects. The Service would also work with interested tribal groups to create a Memorandum of Understanding (MOU) to implement the inadvertent discovery clause of NAGPRA. Development of this MOU would involve identifying the Native American Tribes, Groups, and direct lineal descendants that may be affiliated with these Refuge lands, initiating consultation with the affiliated parties, developing procedures to follow for intentional and inadvertent discoveries, and identifying the persons to contact for the purposes of NAGPRA.

Public Use

The effects of implementing the public use proposals in Alternative B would be the same as those described under Alternative A.

5.6.3 Alternative C (Proposed Action) – Optimize Upland/Wetland Restoration, Improve Opportunities for Wildlife Observation

Wildlife and Habitat Management

Like Alternative B, Alternative C proposes habitat restoration for various locations within the Refuge. The measures described in Alternative B would also be implemented under Alternative C; therefore, with the implementation of these measures, no significant adverse effects to cultural resources as a result of habitat restoration are anticipated.

The only other wildlife and habitat management action proposed under Alternative C that could have an effect on cultural resources is the proposal to remove the drop tower. If the tower is still standing after 2014, it will have been in place for 50 years and would be required to be evaluated for listing on the NRHP prior to formally proposing its removal. If the structure is determined to be eligible to the NRHP, plans to demolish the structure would have to be assessed for potential effects to the historic property. Because the proposal calls for the removal of the structure, if it is deemed eligible to the NRHP, mitigation must be developed and stipulated in a Memorandum of Agreement (MOA) with SHPO and the Advisory Council on Historic Preservation. Other

interested parties, such as local historical societies, would likely be interested parties in this process and would be invited to participate in the MOA. Following this procedure would ensure compliance with all applicable federal policies related to the protection of historic properties; however, additional NEPA analysis would be required prior to removal if the structure were to be deemed eligible for listing on the NRHP. If the structure is removed before 2014 or it is determined that the structure does not meet the criteria for eligibility to the NRHP, then no adverse effects related to cultural resources would result from the removal of this structure.

Public Use

There is little potential for ground disturbing activities to occur in association with an increase in the Refuge's limited public use program; therefore, no adverse effects to cultural resources are anticipated under Alternative C. As described under Alternative A, Refuge staff would continue to work with the Navy to assess potential effects to CA-ORA-298 as a result of conducting special bird watching outings on the Refuge.

Constructing the proposed observation tower could result in some ground disturbance associated with site preparation and footings, therefore, a map indicating the project's APE along with a detailed project description would be submitted for review to the Service's Cultural Resources Program, as well as appropriate Navy cultural resources staff. Based on this information, Service and Navy staff will determine the appropriate measures to be implemented to protect cultural resources. It is anticipated that an archaeological monitor, meeting the Secretary of the Interior's Guidelines, would be required to be present during all ground-disturbing activities.

5.7 Effects to the Social and Economic Environment

This section examines the effects of the three management alternatives to the social and economic environment in which the Refuge is located, including effects related to: land use; public safety; traffic circulation; public utilities/easements; vectors and odors; economics/employment; and environmental justice.

With regard to land use, this section analyzes the potential land use conflicts between the habitat management and public use proposals presented in each alternative and the existing and planned land uses in the immediate vicinity of the Refuge. Adverse effects related to land use would be considered significant if:

- Substantial incompatibility between proposed uses or activities and adjacent existing uses would occur.

- Substantial changes in use or the intensity of use are proposed, where the resulting activity or use pattern would create significant noise, traffic, public safety, or similar environment impacts that would adversely affect the existing or future the use of adjacent areas.

The analysis of impacts related to public safety considers the level to which various current and past activities on or adjacent to the Refuge could pose a hazard to Refuge visitors and/or personnel. Adverse effects related to public safety would be considered significant if:

- Refuge visitors or personnel are present in areas identified by the Navy as potentially hazardous due to the presence or potential presence of ordnance or active small arms fire.

The analysis of impacts related to traffic circulation considers the estimated level of traffic that could be generated by the implementation of the strategies proposed under each alternative. Also

included in this section is an analysis of the potential effects of increased traffic on local and regional traffic circulation. Adverse effects related to traffic would be considered significant if:

- Project-related traffic would exceed accepted increases in roadway volume to capacity ratios as established by the affected jurisdictions.

The public utilities/easements section analyzes the potential effects of the various management alternatives on existing public utilities and easements in the immediate vicinity of the Refuge. Adverse effects to public utilities and easements would be considered significant if:

- Direct or indirect damage to utilities, utility service, or other public facilities would occur as a result of a proposed action.
- Utilities or other public facilities would be relocated, either permanently or temporarily to accommodate a proposed action.

- Disruption of access to a public utility or other facility or temporary obstruction of an easement would occur during implementation of a proposed action.

With regard to vectors and odors, this section discusses the potential prevalence of vector populations under each of the alternatives, as well as the potential generation of unpleasant odors. Effects related to vectors would be considered significant if:

- Habitat changes would necessitate substantially increasing levels of mosquito abatement programs to maintain mosquito populations at pre-project levels (adverse).

- Habitat changes would result in a substantial decline of available mosquito breeding habitat (beneficial).

The generation of offensive odors could represent a nuisance to adjacent residents located in adjacent recreational areas, work sites, and commercial areas. Offensive odors can represent a significant adverse effect if the strength and/or the persistence of the odors are substantial and if the odors would affect a substantial number of people.

With regard to economics/employment, this section discusses the direct and indirect economic effects on the regional economy of implementing the various alternatives presented for the Refuge. Economic or social changes resulting from an action are considered to produce significant effects if they result in a substantial adverse physical change in the environment (e.g., urban blight).

The environmental justice section evaluates the potential for adverse human health or environmental effects to minority populations or low-income populations living in the vicinity of the Refuge as a result of implementing the various actions proposed in each alternative. Impacts related to environmental justice would be considered significant if:

- A proposed action would result in disproportionate adverse human health impacts or environmental effects to low-income or minority populations.

5.7.1 Alternative A – No Action

5.7.1.1 Effects to Land Use

Wildlife and Habitat Management

Under Alternative A, all existing uses and activities on the Refuge would continue. These uses and activities, all of which would continue to be oriented towards wildlife conservation and habitat management, are consistent and compatible with the surrounding mix of land uses on the NWSSB and the adjacent City of Seal Beach as shown in Figure 4-18. Thus, no adverse effects to land use from the wildlife and habitat management associated with Alternative A are anticipated.

Public Use

Proposed public use opportunities at the Refuge, including public tours and bird watching opportunities, would be implemented in compliance with NWSSB's public access policies; therefore, no adverse effect to the uses on the NWS or the surrounding area would result from the continuation of this public use program.

5.7.1.2 Effects Related to Public Safety

Wildlife and Habitat Management

Management of the California least tern nesting population on NASA Island has historically included the use of volunteers to monitor and haze potential avian predators, such as crows and ravens, from the nesting site. The monitoring site for this activity is located in proximity to an existing small arms range located in the southeast corner of the intersection of Bolsa Avenue and Case Road. Having volunteers present in this area when the range is active or "hot," represents a potentially significant hazard to volunteers and Refuge staff. To avoid any significant safety issues, standard operating procedures have been developed between the Refuge and the Navy that requires coordination between Eyes on the Colony volunteers and the operators at the shooting range. Volunteers must be outside the area of potential effect of the shooting ranges at all times when the red flags are up signifying that the range is "hot."

To avoid the potential for impacts to Refuge personnel and volunteers implementing other wildlife and habitat management activities in the vicinity of the small arms range, advanced coordination with NWSSB is required.

Because of the military activities that have occurred on the lands within the Refuge in the past, Refuge staff coordinates with NWSSB prior to any significant ground disturbance in areas with the potential to support unexploded ordinance or other discarded munitions.

Pest Management

The PUP review process is employed to ensure that all chemical pesticides approved for use on the Refuge have been reviewed for their potential impacts not only to the environment, but also to Refuge staff and visitors. Refuge staff and other agencies permitted to apply pesticides on the Refuge are required to comply with use and application instructions on the pesticide labels, which include specifications for personal protective equipment, user safety, storage and disposal, mixing, application, and where necessary appropriate signage to keep the public out of recently sprayed areas. Adherence to these specifications would minimize the potential for public safety impacts related to the use of pesticides on the Refuge.

Public Use

To ensure public safety, visitors are escorted onto the Refuge by Refuge staff and volunteers. Pedestrian access is supervised at all times and is restricted to the existing pedestrian pathway

that extends along Bolsa Avenue between the native plant garden at the visitor contact station to the existing observation deck. Other public access onto the Refuge, such as special tours, are also conducted by volunteers and supervised by Refuge staff.

5.7.1.3 Effects to Traffic Circulation

The current vehicle trips generated as a result of Refuge-related management and public use activities are estimated at a maximum of 10 trips per day during the work week. About 50 to 60 trips may be generated on a weekend day when a public event is occurring on the Refuge. Because the volume of traffic generated by Refuge uses is very low and the majority of the trips occur during non-peak hours, activities on the Refuge have no observable effects on the local and regional transportation system.

5.7.1.4 Effects to Public Utilities/Easements

Wildlife and Habitat Management

The Refuge works closely with NWSSB's Public Works Department to ensure that none of the wildlife and habitat management activities implemented on the Refuge would result in impacts to existing public utilities or easements within or outside of the Refuge boundaries. Therefore, Alternative A would not adversely affect public utilities or easements.

Public Use

Continuation of the existing public use program currently implemented on the Refuge would have limited impacts on public utilities (i.e., limited water consumption and utilization of the sewage system during public tours) and no impacts to existing easements. Therefore, the implementation of the public uses proposed under Alternative A would not result in any significant adverse effects to existing public utilities and easements.

5.7.1.5 Effects Related to Vectors and Odors

Wildlife and Habitat Management

The only management activity that would be implemented on the Refuge under Alternative A that could have an effect on vectors and odors is the proposal to maintain the existing culverts within the restored wetlands. Maintaining these culverts in a manner that ensures adequate tidal circulation with the restored wetlands would reduce the potential for habitat beneficial to mosquito production. The majority of the areas on the Refuge that currently provide habitat for mosquitoes would remain unchanged under this alternative.

Pest Management

As described in Chapter 4, Section 5.2.2.6 and elsewhere in this chapter, mosquitoes, generally considered a vector requiring some level of control, occur on the Refuge. Mosquito control on the Refuge is implemented by the OCVCD in accordance with conditions included in a Refuge Special Use Permit, which is issued annually by the Refuge Manager. Mosquito control would continue under Alternative A and stipulations in the Compatibility Determination for Mosquito Monitoring and Control (Appendix A-3) would ensure that no adverse effects to refuge resources would result from the implementation of mosquito management on the Refuge.

Given Anaheim Bay's status as a reasonably well-flushed coastal salt marsh, characterized by healthy levels of dissolved oxygen, odors do not appear to be a problem at present for nearby residents and visitors. This would not change under Alternative A, and thus this alternative would have no impact related to odors.

Public Use

The public use activities proposed under Alternative A would have no adverse effects related to vectors and odors.

5.7.1.6 Effects to Economics/Employment

Wildlife and Habitat Management

Under Alternative A, the Refuge would continue to maintain its existing staffing levels (i.e., one full time permanent Refuge Manager and one part time term maintenance worker). Therefore, the effects to economics and employment at the local and regional level of implementing Alternative A would be negligible.

Public Use

Since the Refuge would continue to have limited opportunities for public access, the economic benefit of the Refuge to the regional economy is low. The Refuge does however provide some regional economic benefits. An estimate of these benefits was developed using the procedures and data in *Banking on Nature 2006: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation* (*Carver and Caudill 2007*).

The estimate took into consideration the following information. The Refuge's average total number of visitors annually is approximately 1,000, with an average visit lasting four hours. The two special event days draw additional visitors. Since hunting and fishing are not allowed on this Refuge, all of the Refuge's visitors participate in non-consumptive activities such as interpretation and wildlife observation. The retail sales associated with Refuge visitation were calculated using visitor days and the average recreation expenditures per person per visitor day for the Region 1 area, which included California at the time the 2006 study was prepared. Retail sales include lodging and transportation. Table 5-3 depicts the estimated visitation and expenditures for the Seal Beach NWR in 2006 based on this study. Expenditures are likely to be somewhat lower in 2010 as a result of the current economic downturn.

Table 5-3
Estimated Visitation and Expenditures for the Seal Beach NWR in 2009

	Number of Visitors	Visitor Days	Retail Sales
Resident	1,216	607.75	$18,165
Non-Resident	215	107.25	$11,687
Total Impacts	**$1,430**	**$715**	**$29,852**

Using these retail expenditures and a regional multiplier, the final demand was calculated, which is the difference in all final consumers' expenditures in the area attributable to refuge visitation (*Carver and Caudill 2007*). This spending creates jobs. The IMPLAN software was used to calculate the jobs and tax revenue generated from the visitation of the Refuge using Orange County and Los Angeles County data (*Caudill 2008*). These economic benefits are provided in Table 5-4. All of these benefits would continue under Alternative A.

Table 5-4 Economic Impacts from Seal Beach NWR Visitation in 2006					
	Final Demand[1]	**Jobs**	**Job Income**	**Federal Tax Revenue**	**State and Local Tax Revenue**
Resident	$32,384	0.6	$13,587	$2,798	$2,458
Non-Resident	$21,589	0.35	$7,539	$1,963	$1,654
Total Impacts	**$53,973**	**0.95**	**$21,126**	**$4,761**	**$4,112**

[1] Final demand is the difference in all final consumers' expenditures in the area attributable to Refuge visitation.

5.7.1.7 Effects to Environmental Justice

Wildlife and Habitat Management

The wildlife and habitat management activities that would be implemented under Alternative A would have no effects on any areas outside of the Refuge boundary; therefore, there would be no disproportionate adverse impacts on any residents in the region, particularly minority or low-income residents.

Public Use

The continuation of the existing public use program on the Refuge would provide the surrounding public with opportunities to visit the Refuge, as well as provide the public with off-Refuge opportunities to better understand Refuge purposes and the purposes of the NWRS. The public use program would result in no adverse effects on any areas outside of the Refuge boundary; therefore, there would be no disproportionate adverse impacts on any residents in the region, particularly minority or low-income residents.

5.7.2 Alternative B – Maximize Salt Marsh Restoration, Continue Current Public Uses

5.7.2.1 Effects to Land Use

Wildlife and Habitat Management

The wildlife and habitat management actions currently implemented on the Refuge would continue under Alternative B, and the effects of implementing these actions would be the same as described for Alternative A. In addition, Alternative B includes proposal to restore approximately 36 acres of non-native upland habitat on the Refuge to appropriate coastal habitats. None of these proposals are expected to impact the current uses implemented by the Navy on the lands adjacent to the Refuge. To avoid any potential for conflicts, these restoration proposals would be coordinated with NWSSB staff prior to final design. This process would also be implemented for other proposals in Alternative B, including the installation of a new water control structure for the Bolsa Cell, removal of concrete debris from the marsh, and implementation of an IPM program. Therefore, no adverse effects to land use from the wildlife and habitat management associated with Alternative A are anticipated.

Public Use

The effects on land use of continuing the existing public use program under Alternative B would be the same as those described for Alternative A.

5.7.2.2 Effects Related to Public Safety

Wildlife and Habitat Management

Under Alternative B, the effects related to public safety of implementing the wildlife and habitat management practices on the Refuge would be the same as those described for Alternative A.

Pest Management

Under Alternative B, pest management would be implemented in accordance with an IPM Plan (Appendix C) and Mosquito Management Plan (Appendix D). Both of these plans include BMPs for ensuring the no adverse effects to the environment or public safety would result from the use of pesticides on the Refuge. These plans also address the need for posting pesticide application areas when certain products have been applied in order to ensure public and staff safety.

Public Use

The effects related to public safety of continuing the current public use program on the Refuge under Alternative B would be the same as those described for Alternative A.

5.7.2.3 Effects to Traffic Circulation

Wildlife and Habitat Management

The day to day effects to traffic circulation under this alternative would be similar to those described under Alternative A. However, this alternative also includes several restoration proposals that would likely result in short term increases in the number of truck and car trips generated as a result of the construction activity associated with restoration. To minimize the number of trips generated during construction, efforts will be made to dispose of graded material within the boundaries of NWSSB. If material must be trucked off the site, appropriate traffic control measures will be implemented to minimize the effects of these trucks on local traffic. In addition, truck trips will be timed to avoid peak traffic periods. The implementation of these measures would minimize the potential for impacts to traffic circulation.

5.7.2.4 Effects to Public Utilities/Easements

Wildlife and Habitat Management

To avoid any potential for adversely affecting public utilities and easements as a result of restoring habitat on the Refuge, Refuge staff would coordinate all restoration efforts, as well as culvert/water control structure projects with NWSSB prior to finalizing restoration or construction plans. This would ensure that any potential adverse effects to utilities and easements would be avoided.

Public Use

The effects on public utilities/easements of continuing the existing public use program under Alternative B would be the same as those described for Alternative A.

5.7.2.5 Effects Related to Vectors and Odors

Wildlife and Habitat Management

The proposal to restore approximately 36 acres of non-native upland to native coastal habitat is expected to reduce existing habitat for salt marsh mosquito breeding. Areas that currently pond as a result of higher high tides would be recontoured to support high quality native habitat and to reduce the potential for ponding during high tides.

Given Anaheim Bay's status as a reasonably well-flushed coastal salt marsh, characterized by healthy levels of dissolved oxygen, odors do not appear to be a problem at present for nearby

residents and visitors. This would not change under the proposal to increase salt marsh habitat, as described in Alternative B; therefore, this alternative would not result in any significant adverse effects related to odors.

Pest Management

Under this alternative, mosquito control would be implemented in accordance with a Mosquito Management Plan (see Appendix C). This plan, which includes a phased approach to mosquito control, involves the implementation of pesticide and non-pesticide strategies for reducing threats from mosquitoes to human and wildlife populations. Under this plan, impacts to refuge resources from pesticide applications would be expected to be minor, temporary, or localized in nature, and potential impacts to the public as a result of mosquito production on the Refuge would be expected to be minimal.

Public Use

The public use activities proposed under Alternative B would have no adverse effects related to vectors and odors.

5.7.2.6 Effects to Economics/Employment

Wildlife and Habitat Management

Under Alternative B, the Refuge would continue to maintain its existing staffing levels (i.e., one full time permanent Refuge Manager and one part time term maintenance worker). Additionally, several opportunities for contractor work would be created as a result of implementing the restoration, enhancement, and infrastructure proposals included in Alternative B. Carrying out the habitat restoration projects included in Alternative B would inject approximately $3 million into the local economy, temporarily increasing employment and expenditures. However, in the context of the multi-billion dollar Orange County economy, which includes nearly 1.5 million workers, this effect would be negligible.

Public Use

Effects of public use under Alternative B to economics/employment would be identical to those described for Alternative A.

5.7.2.7 Effects to Environmental Justice

Wildlife and Habitat Management

The expanded wildlife and habitat management activities associated with Alternative B would not create any adverse impacts that could disproportionally affect minority or low-income residents in the region.

Public Use

The benefits of implementing the current public use program, which is proposed to continue under Alternative B, would be identical to those described for Alternative A.

5.7.3 Alternative C (Proposed Action) – Optimize Upland/Wetland Restoration, Improve Opportunities for Wildlife Observation

5.7.3.1 Effects to Land Use

Wildlife and Habitat Management

The effects to land use of implementing the wildlife and habitat management actions proposed under Alternative C would be essentially the same as those described for Alternative B.

Public Use

Despite limited increases in public use opportunities at the Refuge under Alternative C, overall public use opportunities would remain at a sufficiently small scale and would have no adverse effects to land uses on the NWSSB or properties within the City of Seal Beach.

5.7.3.2 Effects Related to Public Safety

Wildlife and Habitat Management

The effects to public safety of implementing the wildlife and habitat management practices on the Refuge associated with Alternative C would be the same as those described for Alternative B.

Pest Management

The effects to public safety under Alternative C as they relate to pest management would be the same as those described under Alternative B.

Public Use

The effects related to public safety of increasing the number of public events permitted on the Refuge as described under Alternative C would be the same as those described for Alternative A. In addition, any new public use facilities, such as the proposed observation platform, would be constructed well away from the small arms range and selection of construction sites would be coordinated with the Navy to avoid potential hazards associated with ordnance.

5.7.3.3 Effects to Traffic Circulation

Some short term increases in construction traffic, similar to those described under Alternative B, would occur as a result of the restoration proposals included under this alternative. Through the implementation of the measures described under Alternative B, no adverse impacts to traffic circulation would be anticipated. Also under Alternative C, the total number of Refuge staff could increase by one, generating potentially four additional trips per day. This would increase the total trips generated as a result of everyday Refuge-related management activities to 14 trips per day during the work week. Expansion of the public use programs would increase the number of weekends in which trips to and from the Refuge would be generated, but the estimate of about 50 to 60 trips generated per weekend day when a public event is occurring on the Refuge would remain the same. Therefore, under this alternative, the volume of traffic generated by Refuge uses would remain low and the majority of the trips would continue to occur during non-peak hours. Therefore, no observable effects on the local and regional transportation system are anticipated.

5.7.3.4 Effects to Public Utilities/Easements

Wildlife and Habitat Management

The effects on public utilities/easement of implementing the wildlife and habitat management actions proposed under Alternative C would be essentially the same as those described for Alternative B.

Public Use

Even with minor increases in public use, as proposed under Alternative C, the Refuge's public use program would have limited impacts on public utilities (i.e., limited water consumption and utilization of the sewage system during public tours) and no impacts to existing easements. Therefore, the implementation of the public uses proposed under Alternative C would not result in any significant adverse effects to existing public utilities and easements.

5.7.3.5 Effects Related to Vectors and Odors

Wildlife and Habitat Management

Effects to surrounding areas related to vectors and odors that could be generated on the Refuge would be similar to those described above for Alternative B. Additionally, as described under Alternative B, the implementation of the restoration proposals on the Refuge are not expected to result in adverse impacts related to odors.

Pest Management

The effects of the pest management proposals included under Alternative C would be same as those described under Alternative B.

Public Use

The public use proposals included in Alternative C would have no adverse effects related to vectors and odors.

5.7.3.6 Effects to Economics/Employment

Wildlife and Habitat Management

The effects to economics/employment of implementing the wildlife and habitat management plans included in Alternative C would be essentially the same as those described for Alternative B. The cost of restoration would be slightly lower under Alternative C, as less excavation would be required to achieve wetland/upland transitional and native upland habitat.

Public Use

Effects to economics/employment of expanding the public use program as proposed in Alternative C would be somewhat larger than those of Alternatives A and B (refer to Sections 5.7.1.5 above), as several hundred additional visits to the Refuge could be realized under Alternative C. In spite of this increase, these economic benefits of implementing Alternative C would still be negligible in comparison with the economies and employment bases of Orange County and metro Los Angeles.

5.7.3.7 Effects to Environmental Justice

Wildlife and Habitat Management

Wildlife and habitat management activities proposed under Alternative C would not have disproportionate adverse impacts on minority or low-income residents in the region.

Public Use

The public use program proposed under Alternative C would expand opportunities for the public to observe and better understand the habitats and wildlife supported on the Refuge. The availability of this resource in proximity to several lower income communities would represent a benefit to these communities and would not result in disproportionate adverse impacts on minority or low-income residents in the region.

5.8 Indian Trust Assets

Indian trust assets (ITAs) are legal interests in assets that are held in trust by the United States Government for Federally recognized Indian tribes or individuals. The trust relationship usually stems from a treaty, Executive Order, or act of Congress. The Secretary of the Interior is the trustee for the United States on behalf of federally recognized Indian tribes. “Assets” are anything owned that holds monetary value. “Legal interests” means there is a property interest for which there is a legal remedy, such as compensation or injunction, if there is improper

interference. Assets can be real property, physical assets, or intangible property rights, such as a lease, or right to use something. ITAs cannot be sold, leased or otherwise alienated without the United States' approval. Trust assets may include lands, minerals, and natural resources, as well as hunting, fishing, and water rights. Indian reservations, Rancherias, and public domain allotments are examples of lands that are often considered trust assets. In some cases, ITAs assets may be located off trust land.

The Service shares the responsibility with all other agencies of the Executive Branch to protect and maintain ITAs reserved by or granted to Indian tribes, or Indian individuals by treaty, statute, or Executive Order.

There are no known tribes possessing legal property interests held in trust by the United States in the lands or natural resources addressed in the alternatives for this CCP.

5.9 Cumulative Effects

Cumulative effects can result from the incremental effects of a project when added to other past, present, and reasonably foreseeable future projects in the area. Cumulative impacts can result from individually minor but cumulatively significant actions over a period of time. Such impacts can be difficult to quantify, as this would require speculative estimates of impacts such as the geographic diversity of impacts (i.e., impacts associated with various developments may affect different areas), variations in timing of impacts (i.e., impacts from the various proposals would likely occur at different times, particularly in the case of temporary construction impacts), complete data are not available for all future development, and data for future development may change following subsequent approvals. Despite these limitations, a qualitative cumulative impact analysis is presented that describes the combined effect of, and relationship between projects in the general vicinity of the Seal Beach NWR.

In conducting this analysis, the interaction of activities at Seal Beach NWR with other actions occurring over a larger spatial reference and a temporal reference of about 15 years (the intended life of this CCP) has been considered. For purposes of this analysis, a list of recently approved, currently proposed, and reasonably foreseeable future projects within a ten mile radius of the Refuge have been compiled and are presented below.

Integrated Natural Resources Management Plan Naval Weapons Station Seal Beach
The purpose of the INRMP is to provide NWSSB with a viable framework for future management of natural resources on lands it owns or controls. When completed, the INRMP, a five-year, ecosystem-based plan to be developed in cooperation with the Service and the California Department of Fish and Game, will facilitate compliance with natural resource protection laws, integrating the military mission of the NWS with the natural resource component of existing plans for NWSSB. The proposals in the INRMP cover all of NWSSB, including the Refuge, and the INRMP proposals for the Refuge are consistent with the proposals in the draft CCP. In addition to the proposals described for the Refuge, the INRMP also includes a number of conceptual restoration proposals for areas of the station located beyond the Refuge boundary. These include the restoration of high to mid-marsh habitat at the southeast corner of the station, coastal grassland enhancement, and bluff and beach dune special status species enhancement.

Harmony Cove Residential Condo and Marina Development
This project, which would be constructed on a 2.28-acre site located approximately 1.5 miles to the southeast of the Refuge, involves a proposal to construct 15 condominiums and a 25-boat slip marina. Construction of the marina would require replacement of an existing revetment of rock riprap with a vertical seawall. Approximately 16,000 cubic yards of material would be dredged from the submerged portion of the site, which is part of the Huntington Harbour channels. Impervious areas on the site would increase from 80 percent coverage to 90 percent coverage, representing a slight increase in runoff over existing conditions.

Los Cerritos Wetlands Conceptual Restoration Plan
Approximately 600 acres of disturbed and functional wetlands are included within an area referred to as the Los Cerritos Wetlands. This wetland complex, situated approximately two miles northeast of the Refuge, is located on both the north and south side of the San Gabriel River. Conceptual restoration planning envisions full tidal flushing, if possible, for the entire wetland complex. Funding and a time table for implementation of a phased restoration project have not yet been identified.

Alamitos Bay Marina Rehabilitation Project
The project site consists of various marina basins located throughout Alamitos Bay. The project, which is situated approximately 2.5 miles north of the Refuge, proposes to rehabilitate existing marina facilities by restoring existing boats slips; dredge approximately 300,000 cubic yards of material from various basins within the bay to restore the original design depths; and repair and/or replace associated marina facilities, such as restrooms, seawalls, and parking lots. The proposed project is anticipated to be implemented in 12 phases over approximately six years.

Bahia Marina
This project, located approximately 2.5 miles north of the Refuge, involves maintenance dredging for the Cerritos Bahia Marina to maintain sufficient water depth for marina operations. The volume of material to be removed is 26,867 cubic yards and the project will take approximately 66 days to complete.

Shops at Rossmoor
Three separate building construction projects are proposed for this area, which is located near the corner of Seal Beach Boulevard and St. Cloud Drive, approximately three miles to the north of the Refuge. The proposed construction includes a 17,500- square-foot drug store, a 6,000-square-foot retail building, and a 3,500-square-foot fast food facility.

Second+PHC Project
This mixed-use development with retail, residential, hotel, restaurant, and entertainment uses would be constructed on approximately 11 acres located about three miles north of the Refuge. Located between the San Gabriel River and the Los Cerritos Channel at the southwest corner of Pacific Coast Highway (PCH) and 2nd Street in the City of Long Beach, this development would include retail uses, 325 residential units, a 100-room hotel, a theater, restaurant space, and a marine/science learning center.

Bolsa Chica Lowlands Restoration
Major construction activity for the Bolsa Chica Lowlands Restoration project, located approximately four miles south of the Seal Beach NWR, was completed at the end of 2006. The restoration process continues, with biological, physical, and beach conditions monitoring programs being implemented to document the changing conditions over time. The project

involved excavation of the project site to restore approximately 560 acres of tidally influenced habitat within the Bolsa Chica Ecological Preserve. To restore the site, approximately 1.8 million cubic yards of material was removed to create full tidal and muted tidal basins. The project is expected to result in the creation of subtidal, tidal flats, cordgrass- and pickleweed-dominated salt marsh, and native upland habitats.

Colorado Lagoon Restoration
This project involves the restoration and enhancement of an approximately 12-acre tidally influenced body of water, Colorado Lagoon. Colorado Lagoon, which is located approximately five miles north of the Refuge, is connected to Alamitos Bay and the Pacific Ocean through an underground tidal culvert to Marine Stadium. The purpose of the proposed project is to restore the site's ecosystem, improve the estuarine habitat, provide enhanced recreation facilities, improve water and sediment quality, and manage storm water.

Goldenwest Assisted Living Facility
This project involves the construction of a 120,000-square-foot convalescent facility on 3.38 acres of previously developed property, located approximately six miles southeast of the Refuge. The proposed convalescent facility would include senior assisted living and Alzheimer's/memory care components with 13 studio units, 85 one-bedroom units, and 23 two-bedroom units. Approximately 70 people will be employed within the facility, with a maximum of 36 employees per shift.

The Ridge – A 22-Unit Single-Family Development
This project proposes the development of 22 single-family units on five acres located approximately seven miles southeast of the Seal Beach NWR. The project also involves the construction of infrastructure improvements including street, curbs, sidewalks, and storm drain facilities.

Orizaba Park Expansion Project
The Orizaba Park Expansion Project is a comprehensive master plan for an existing park located approximately seven miles north of the Refuge. The project also involves the acquisition of a 1.10-acre parcel to accommodate expansion of the existing park. Construction to implement proposed park improvements began in late 2009.

Aquarium of the Pacific
The proposed project involves the construction of a 23,330-square-foot addition, representing a 14 percent floor area increase, to the existing 166,447-square-foot aquarium facility in Long Beach, approximately eight miles north of the Refuge. The project consists of a new wing with a "media-based chamber," an expanded retail store, and a new front entrance.

Magnolia Marsh Restoration
The restoration of the Magnolia Marsh, located about 10 miles south of the Seal Beach NWR, involved the excavation of approximately 40,000 cubic yards of fill to recreate a historical channel system, remove the seaward levee of the Huntington flood control channel to restore tidal influence, and restore approximately 41 acres of coastal wetlands. Excavation was completed in spring 2010.

Seawater Desalination Project at Huntington Beach
Poseidon Resources Corporation proposes to construct and operate a 50 million gallon per day seawater desalination facility within the City of Huntington Beach. The proposed desalination project would consist of a seawater intake system, pretreatment facilities, a seawater

desalination facility utilizing reverse osmosis technology, post-treatment facilities, product water storage, chemical storage, electrical substation, on- and off-site booster pump stations, and 48- to 54-inch diameter product water transmission pipelines in Huntington Beach and Costa Mesa. The project site is located approximately 10 miles to the south of the Seal Beach NWR on a 13-acre site located at 21730 Newland Street in Huntington Beach.

Off-site construction associated with underground booster pump stations, a bypass station, and two metering stations is also proposed in the vicinity of the proposed plant. Optional water transmission pipeline routes and pump stations are also being considered for installation in Huntington Beach, Fountain Valley, Westminster, Garden Grove, Santa Ana, and Costa Mesa.

Newland Street Widening
The widening of Newland Street between Pacific Coast Highway and Hamilton Avenue, including widening reinforced concrete bridge at Huntington Channel, installation of storm drain in Newland Street, and miscellaneous utility relocations is currently underway. The project site is located approximately ten miles south of the Seal Beach NWR.

Edison Community Center
This proposal by the City of Huntington Beach Community Services Department involves the establishment of a park Master Plan to reconfigure existing open space areas at the Edison Community Center, located approximately ten miles southeast of the Refuge. The project proposes to construct additional recreational amenities, reconfigure an existing parking lot and construct new parking areas, install new landscape and hardscape, and construct four lighted practice soccer fields and a lighted multi-purpose field. The master plan is proposed to be carried out in four phases of construction over eight years.

This list of projects includes a combination of development and habitat enhancement projects. The majority of the construction projects represent redevelopment in previously disturbed areas, while a few represent new development. All would involve temporary impacts associated with the use of construction equipment, but only the development projects would result in long-term use of resources such as power and water and long-term effects related to air emissions and urban runoff.

5.9.1 Cumulative Effects to the Physical Environment

The projects included in the cumulative effects analysis range from new development and redevelopment to habitat restoration. The development and redevelopment projects would result in modifications to existing community character and visual quality within the area immediately surrounding the different project sites. Habitat restoration and management proposals, such as those proposed as part of the Seal Beach NWR CCP, would alter the existing character of the land by converting disturbed uplands and wetlands to higher quality habitat areas that are reminiscent of prior undisturbed historic conditions. All of these proposals would result in incremental changes in community character and/or visual quality, but would not be considered of a sufficient magnitude to constitute a significant cumulative effect.

With respect to water quality, the redevelopment and development projects would result in increases in impervious surfaces, resulting in incremental increases in urban runoff entering existing flood control channels, natural and developed waterways, estuaries, and the Pacific Ocean. The habitat restoration projects could result in temporary increases in turbidity in adjacent waterways, however, through the implementation of best management practices, these temporary impacts would be expected to be minimal. Following restoration, these wetlands would provide incremental benefits to downstream water quality as a result of the natural filtering process provided by wetland vegetation. The proposal to implement the Seal Beach NWR CCP would not

however significantly contribute to cumulative water quality impacts or benefits in the general area.

Impacts from the operation of construction equipment associated with development, facilities improvements or maintenance, and restoration, although relatively short in duration, would contribute incrementally to the overall concentration of fugitive dust and particulate matter in the air, as well as incrementally contribute to temporary increases in ozone levels within the Region. These operations would also result in the generation of GHG emissions. The cumulative effect of these temporary increases in air emissions is difficult to quantify because the projects would be implemented at different times, with only a portion of the projects occurring at any given time. Because the generation of fugitive dust, particulate matter, ozone, and GHGs as a result of implementing the restoration proposals included in the Seal Beach NWR CCP would be relatively low and only generated for a limited time, the cumulative contributions from this project to the local, regional, and global environment are not considered significant. Implementation of the Seal Beach NWR CCP would not result in any measurable increases in the existing operational emissions associated with Refuge management, nor would Refuge operations exceed regional pollutant emission thresholds of significance. Therefore, the proposal would not contribute cumulatively to long term regional air quality impacts or the production of long-term GHG emissions.

5.9.2 Cumulative Effects to Biological Resources

The majority of the development projects proposed in the vicinity of the Refuge are redevelopment projects that are not expected to impact significant biological resources. A few projects are proposed in or adjacent to sensitive habitat areas and could result in disturbance to wildlife, impacts to native habitat, or impacts to the marine environment. The restoration projects proposed in the area could result in temporary impacts to biological resources; however, these impacts would be minimized by avoiding construction activity during the breeding seasons, while other impacts would be offset by the benefits of restoration. Any adverse effects to biological resources as a result of the implementation of the CCP would be minor and would not represent a significant cumulative effect to biological resources.

5.9.3 Cumulative Effects to Cultural Resources

Adherence to the policies and regulations pertaining to the protection of cultural resources would avoid or mitigate any significant adverse effects as a result of implementing the various projects listed above; therefore, the proposed project would not result in any adverse cumulative impacts to cultural resources.

5.9.4 Cumulative Effects to the Social and Economic Environment

Although several of the projects being considered for development in the vicinity of the Refuge would generate traffic volumes that could have cumulative effects on the local and regional circulation systems, the minor increases in the already low levels of traffic generated as a result of Refuge activities would not contribute cumulatively to localized or regional traffic impacts.

Although the development proposals in the vicinity of the Refuge would result in a cumulative increase in the demand for water, sewer, and energy, the proposals in the CCP would not result in any increases in the long-term demand for water, sewer, or energy on the Refuge.

A number of restoration proposals are under consideration in the project vicinity which when implemented could provide habitat for various vectors, primarily salt marsh mosquitoes. The restored conditions on these sites would however be less likely to support the diversity and

abundance of mosquitoes currently supported within disturbed wetland areas. Therefore, the restoration proposals on the Refuge, as well as those proposed in the general project vicinity, would not result in a significant cumulative impact related to vectors.

The proposals included in the CCP would have no effect on issues related to environmental justice; therefore, the implementation of the CCP would not contribute to any impacts related to environmental justice that may result from the implementation of the other projects under consideration in the general vicinity of the project.

5.10 Summary of Effects

Provided in Table 5-5 is a summary of the potential effects associated with each of the alternatives evaluated as part of the Seal Beach NWR CCP.

Table 5-5
Summary of Potential Effects of Implementing Alternatives A, B, or C for the Seal Beach National Wildlife Refuge Comprehensive Conservation Plan

Resource	Alternative A	Alternative B	Alternative C
Physical Environment			
Topography	No changes to the existing topography on the Refuge occur as a result of implementing ongoing Refuge activities	Proposed restoration efforts would change the topography and elevations on approximately 36 acres of the Refuge; these changes would not result in any adverse effects to the existing topographic character on the Refuge	Same as Alternative B
Visual Quality	No adverse effects to the existing visual quality of the Refuge lands occur as a result of implementing ongoing Refuge activities	Temporary, minor adverse effects to visual quality would occur during site preparation for habitat restoration; the long-term effect of the restoration process would be improved visual quality within the restoration sites	Same as Alternative B; the installation of an elevated observation platform would alter the visual character of the area near the intersection of Kitts Highway and Bolsa Avenue, however, this change in visual character would not represent a significant impact on the environment

Table 5-5
Summary of Potential Effects of Implementing Alternatives A, B, or C for the Seal Beach National Wildlife Refuge Comprehensive Conservation Plan

Resource	Alternative A	Alternative B	Alternative C
Physical Environment			
Geology/Soils	No adverse effects related to geology and soils occur on the Refuge as a result of implementing ongoing Refuge activities, including annual preparation of the least tern nesting site on NASA Island	Habitat restoration would remove artificial fill to achieve elevations supportive of type of habitat proposed for each site. BMPs to minimize erosion would be implemented, reducing potential impacts to below a level of significance	Same as Alternative B
Agricultural Resources	No agricultural resources are present on the Refuge; current Refuge operations have no effect on adjacent agricultural fields	Same as Alternative A	Same as Alternative A
Hydrology	Ongoing Refuge activities such as culvert replacement, as needed, result in improvements in tidal circulation within the marsh; no activities are implemented that adversely affect tidal circulation within the Refuge	Installation of a water control structure to control tidal flows entering and exiting the Bolsa Cell would provide benefits to the tidal circulation within the Bolsa Cell and is not expected to impact tidal circulation elsewhere on the Refuge; other culvert and/or water control structures could be replaced if needed to improve tidal circulation within the Refuge	Same as Alternative B

Table 5-5
Summary of Potential Effects of Implementing Alternatives A, B, or C for the Seal Beach National Wildlife Refuge Comprehensive Conservation Plan

Resource	Alternative A	Alternative B	Alternative C
Physical Environment			
Water Quality	Periodic application of EPA and Service-approved herbicides as part of chemical control of invasive plants is not anticipated to adversely impact water quality	No adverse effects are anticipated, water quality monitoring and coordination with other agencies to improve water quality entering the marsh from upstream could eventually improve water quality throughout the marsh; BMPs would be implemented during restoration/enhancement projects, and BMPs would be implemented per the IPM and Mosquito Management Plans	Same as Alternative B
Air Quality	No change in existing air quality conditions and no adverse effects	Temporary, localized, impacts to air quality from construction equipment used to implement habitat restoration; no significant long-term impacts to air quality would occur; implementing BMPs in the IPM and Mosquito Management Plans would avoid impacts to local air quality	Same as Alternative B
Biological Resources			
Native Habitat	No adverse impacts to existing native habitats would result; habitat maintenance and management would benefit these habitats	The overall acreage of native habitats would increase as a result of proposed restoration; invasive plant removal and replacement with native upland species would also provide minor benefits	Same as Alternative B

Table 5-5
Summary of Potential Effects of Implementing Alternatives A, B, or C for the Seal Beach National Wildlife Refuge Comprehensive Conservation Plan

Resource	Alternative A	Alternative B	Alternative C
Biological Resources			
Waterfowl, Seabirds, Shorebirds and Other Waterbirds	Not likely to result in any changes to the current diversity and abundance	Habitat restoration and enhancement activities would provide minor benefits to these birds	Same as Alternative B
Landbirds	Not likely to result in any changes to the current diversity and abundance of these birds on the Refuge	Would likely result in a minor, indirect adverse effect to landbirds due to conversion of existing disturbed upland habitat to salt marsh and wetland/upland transitional habitat	Less likely to result in a minor, indirect adverse effect to landbirds as existing disturbed upland habitat would be converted primarily to native upland and wetland/upland transitional habitat
Fish and other Marine Organisms	Ongoing Refuge maintenance projects, such as culvert replacement, indirectly benefits fish by improving water circulation in the marsh	Proposed restoration and enhancement projects would likely result in some indirect beneficial effects to fish populations; implementing BMPs and other conditions during the application of pesticides would minimize the potential for adverse effects; the use of Natular in coastal wetlands could adversely affect fish and marine organisms	Same as Alternative B, except Natular is not proposed for use on the Refuge under this alternative
Invertebrates, Amphibians, and Reptiles	Presence/ distribution of invertebrates, amphibians, and reptiles would be unlikely to change	Minor, indirect adverse effects could result from restoration/enhancement projects due to loss of transitional habitat; BMPs during pesticide use will minimize adverse effects from pesticides	Generally the same as Alternative B, but under Alternative C a tiger beetle management plan would be implemented to protect tiger beetle populations on the Refuge

Table 5-5
Summary of Potential Effects of Implementing Alternatives A, B, or C for the Seal Beach National Wildlife Refuge Comprehensive Conservation Plan

Resource	Alternative A	Alternative B	Alternative C
Biological Resources			
Mammals	Presence, distribution, and abundance of mammals would be unlikely to change; predator management could result in the loss of individual mammals that pose a threat to listed species	No adverse effects to mammals are anticipated	Same as Alternative B
Endangered and Threatened Species			
California Least Tern	Management actions would continue to benefit nesting terns on NASA Island	Same as Alternative A, plus habitat restoration/ enhancement actions would provide minor benefits to fish species preyed upon by foraging least terns; removal of potential avian predator perches would benefit tern chicks and eggs; activities near the tern nesting site would be limited to the non-nesting season to reduce the potential for disturbance	Same as Alternative B, plus the removal of the drop tower would further reduce the ability of potential avian predators to perch in the vicinity of NASA Island
Light-footed Clapper Rail	Management actions, including monitoring, predator control, and nesting platform maintenance would continue to benefit this species	Same as Alternative A, plus benefits from actions to improve nesting conditions, remove potential avian predator perching sites, and restore/enhance habitat. Construction would be restricted seasonally near rail habitat; BMPs and site restrictions would be imposed to minimize impacts related to pesticide use	Same as Alternative B, plus the removal of the drop tower would further reduce perching sites for potential avian predators, upland and wetland/upland transitional habitat restoration areas would provide cover for rails during periods of high tide, proposals to improve cordgrass vigor would also benefit rails

Table 5-5
Summary of Potential Effects of Implementing Alternatives A, B, or C for the Seal Beach National Wildlife Refuge Comprehensive Conservation Plan

Resource	Alternative A	Alternative B	Alternative C
Endangered and Threatened Species			
Western Snowy Plover	Management actions are not implemented specifically to benefit the plover	No adverse effects to this species would occur under this alternative	Same as Alternative B
Salt Marsh Bird's Beak	Not currently present on the Refuge; therefore no adverse or beneficial effects to this species are realized	Same as Alternative A	Reintroduction of this species to the Refuge, if successful, would represent a significant benefit to the species and its possible future recovery
Eastern Pacific Green Turtle	No management actions are implemented specifically to benefit this species	Restoration and enhancement projects could impact this species; design and construction specifications incorporated into the scope of these projects would minimize the potential for impacts	Same as Alternative B
Belding's Savannah Sparrow	No management actions are implemented specifically to benefit this species	Restoration and enhancement of salt marsh habitat could benefit this species; construction and public use activities would be planned to avoid impacts during the nesting season	Potential benefits would be less than under Alternative B, as this alternative emphasizes restoration of upland and wetland/upland transitional habitat
Cultural Resources			
Cultural, historical, and archaeological resources	Adherence to existing regulations/policies would minimize the potential for impacts to cultural resources	Same as Alternative A	Same as Alternative A

Table 5-5
Summary of Potential Effects of Implementing Alternatives A, B, or C for the Seal Beach National Wildlife Refuge Comprehensive Conservation Plan

Resource	Alternative A	Alternative B	Alternative C
Social and Economic Environment			
Land Use	No adverse effects to land use	Same as Alternative A	Same as Alternative A
Public Safety	Potential for adverse effects to public safety are minimized through access policies	Same as Alternative A	Same as Alternative A
Traffic Circulation	Trips generated as a result of Refuge activities would be too low to result in an observable impacts to traffic circulation	Same as Alternative A	Same as Alternative A
Public Utilities/ Easements	No adverse effects on existing public utilities and easements	Same as Alternative A	Same as Alternative A
Vectors and Odors	Mosquitoes are known to occur on the Refuge, impacts are minimized through existing monitoring and control activities by OCVCD; odors are not an issue on the Refuge	Implementation of the Mosquito Management Plan would ensure the protection of wildlife while also addressing the need to protect public health and safety; no issues related to odor	Same as Alternative B
Economics/Employment	Effects to economics and employment both locally and regionally would be negligible	Same as Alternative A	Same as Alternative A
Environmental Justice	No adverse impacts on minority or low-income residents as a result of Refuge activities; however the proximity of the Refuge to large urban populations would increase opportunities for the public to connect with the resources protected in the NWRS	Same as Alternative A	Same as Alternative A

6 Implementation

6.1 Introduction

This chapter presents the details of how the proposed action (Alternative C) for the Seal Beach NWR would be implemented if it is selected as the preferred alternative when the Final CCP is approved. The planning team recommends this proposed action as the alternative that could best achieve Refuge purposes, vision, and goals while helping to fulfill the Refuge System mission. Management under Alternative C acknowledges the importance of naturally functioning ecological communities on the Refuge. However, changes to the landscape have affected the ability of the Service to manage the Refuge solely as a naturally functioning ecological community. Those changes resulted from human alterations to the landscape, past refuge management to restore wetlands, and special management actions to protect listed species.

Refuge goals and objectives, as well as the specific strategies (projects) for achieving the goals and objectives, are presented below. Although it is our intent to implement the proposed strategies by the dates presented in this chapter, the timing of implementation may vary depending upon a variety of factors, including funding, staffing, compliance with Federal regulations, partnerships, and the results of monitoring and evaluation. Some strategies, such as those related to habitat restoration, will require the preparation of step-down plans, coordination with NWSSB, and completion of appropriate environmental compliance documents before they can be implemented. During the 15 years following CCP approval, the CCP will serve as the primary reference document for all Refuge planning, operations, and management. The strategies presented would be implemented with assistance from new and existing partners, including public agencies, tribes, non-governmental organizations, and the public. Consistent public outreach and continued coordination with Refuge constituents are essential components of this implementation process. Some of the partnership opportunities to be explored during the 15-year life of this CCP are also described below, as are the step-down plans, monitoring responsibilities, and staffing and funding requirements needed to successfully implement the CCP.

CCPs are intended to evolve with each Refuge, and the Improvement Act specifically requires that these plans be formally revised and updated at least every 15 years. The formal revision process will follow the same steps as those implemented for the initial CCP development process, with a major emphasis placed on public involvement. Until a formal revision is initiated, the Service will periodically review and update the CCP (at least as often as every five years) to address needs identified as a result of monitoring or in response to adaptive management procedures. This CCP will also be informally reviewed by Refuge staff while preparing annual work plans and updating the Refuge databases. It may also be reviewed during routine inspections or programmatic evaluations. Results of any or all of these reviews may indicate a need to modify the plan. The goals described in this CCP will not change until they are reevaluated as part of the formal CCP revision process. However, the objectives and strategies may be revised to better address changing circumstances or to take advantage of increased knowledge of Refuge resources. If revisions to the CCP are required prior to the initiation of formal revisions, the level of public involvement and associated NEPA documentation will be determined by the Refuge Manager.

6.2 Refuge Goals, Objectives and Strategies

The development of the Refuge vision and goals, which is defined in greater detail in Chapter 2, is one of the most important components of the CCP process. It is through this process that we establish the desired future conditions of the Refuge.

Our vision of the future conditions on the Seal Beach NWR is:

> *Tidal channels meandering through a sea of cordgrass deliver moisture and nourishment to support a healthy marsh ecosystem. As the quiet calm of the morning is interrupted by the clacking of a light-footed clapper rail, school children and other visitors, standing on the elevated observation deck, point with excitement in the direction of the call hoping for a glimpse of the rare bird. Shorebirds dart from one foraging area to another feasting on what appears to be an endless supply of food hidden within the tidal flats. California least terns fly above the tidal channels searching for small fish to carry back to their nests on NASA Island. A diverse array of marine organisms, from tube worms and sea stars to rays and sharks, and even an occasional green sea turtle, thrive within the tidal channels and open water areas of the Refuge's diverse marsh complex, while Nelson's sharp-tailed sparrows and other upland birds find food and shelter within the native upland vegetation that borders the marsh.*

Goals and objectives are the unifying element of Refuge management, intended to identify and focus management priorities and provide a link between management actions, Refuge purposes, and NWRS mission and goals. The objectives, which are concise statements of what will be achieved to meet a particular goal, are derived from the goals and provide the basis for determining strategies and monitoring Refuge accomplishments. Refuge strategies describe specific actions, tools, and techniques that can be used to meet Refuge objectives. In some cases, strategies describe specific projects in enough detail to assess funding and staffing needs. In other cases, further site-specific detail is required to implement a strategy. This additional detail takes the form of a step-down management plan, restoration plan, or site plan.

Although the goals are the same for each of the three alternatives described for the Seal Beach NWR, there are a variety of ways in which to achieve these goals. Therefore, the objectives and strategies for each goal vary among alternatives. The following discussion presents objective statements and associated strategies for each Refuge goal. The objectives have been written to address the proposed action (Alternative C). In addition, the various strategies that would implement the objective in whole or in part are provided in a table format that allows the reader to determine which strategies would be implemented under each alternative. Specific acreage figures, time frames, and other measurable elements presented in the objectives may change depending upon which alternative is ultimately selected for implementation.

The goals, objectives, and strategies for the proposed action are presented below.

Goal 1: Support recovery and protection efforts for the federally and state listed threatened and endangered species and species of concern that occur within the Seal Beach NWR.

***Objective 1.1*: California Least Tern**
Maintain the three-acre least tern nesting site on NASA Island as suitable nesting habitat for the California least tern to support an average of 0.50 fledged chicks per least tern pair over a period of fifteen years.

Rationale: Many of the historic nesting grounds once used by the California least tern have been lost to intensive human encroachment along the coast, causing this tern to seek nesting sites on mud and sand flats set back from the ocean. NASA Island, an artificial upland area located in Anaheim Bay, is one of these alternate types of nesting sites. Foraging opportunities for least terns using this nesting site include Anaheim Bay and the Pacific Ocean, which is located less than one mile from the site. Least tern nesting on NASA Island has occurred annually since 1979. The number of breeding pairs using NASA Island has fluctuated over the years, with a low of 30 breeding pair recorded in 2003 (*Collins 2007*) and a high of 260 in 2010 (per comm. Marschalek 11/17/10). Between 2004 and 2010 the average numbers of nesting pairs per year observed at NASA Island was 183 pairs (refer to Table 4-8 for more information). The reasons for the annual fluctuations in numbers of nesting pairs at the site are not known.

Factors influencing nesting success or failure, such as food supply and predation, are somewhat better understood. Nesting success can be affected by the number of mammalian and avian predators present, the amount of nesting activity occurring in a given area, the presence or absence of appropriate nesting substrate, and access to adequate food sources. At NASA Island, providing support for successful tern nesting requires annual predator management and vegetation control. Occasional substrate enhancements (e.g., capping the nesting area with sand and adding shell fragments) is also required. Such measures are consistent with recovery actions presented in the approved California Least Tern Recovery Plan (*USFWS 1985a*).

The Recovery Plan suggests that a three-year mean reproductive rate of no less than 1.0 young fledged per breeding pair should be achieved to recover the species (*USFWS 1985a*). However, recent recovery data presented in the Five Year Review for the California Least Tern (*USFWS 2006b*) suggest that the overall population of this tern has increased at lower productivity levels. For example, the tern's reproductive rate in 2005 was considerably lower (0.23 to 0.36 fledglings per pair) than the values recommended for recovery in the Recovery Plan, while the overall population of this tern has increased from 600 pairs in 1973 to approximately 7,100 pairs in 2005 (*USFWS 2006b*). This greatly exceeds the suggested population levels in the Recovery Plan of 1,200 pairs nesting in 20 management areas (*USFWS 1985a*). Through continued management actions, including predator control, the objective of 0.50 fledglings per pair over a 15 year period is considered achievable at Seal Beach and is highly likely to benefit recovery efforts for this species.

Objective 1.1 - California Least Tern ***Comparison by Alternative***			
Alternative			
A	**B**	**C**	*Strategy*
✓	✓	✓	Continue to partner with NWSSB to annually prepare the NASA Island site for least tern nesting by removing weedy vegetation, maintaining an adequate sand cap of six to twelve inches of light sand, adding shell fragment as needed, and ensuring that the surrounding fence is in good repair.
✓	✓	✓	Conduct predator management in accordance with the approved *Endangered Species Management and Protection Plan* to reduce predation of least tern chicks, eggs, and adults.

Objective 1.1 - California Least Tern (continued) *Comparison by Alternative*			
Alternative			
A	B	C	Strategy
✓	✓	✓	Reduce mammalian disturbance in the nesting area by annually maintaining electrified fencing around the site.
✓	✓	✓	Utilize volunteers to monitor the least tern colony from a distance, implement hazing to scare off potential avian predators, and inform the Refuge Manager of any evidence of the presence of potential predators in and around the nesting site.
✓	✓	✓	Annually monitor nesting season activity, fledgling productivity, and type and extent of predation.
	✓	✓	Coordinate with NWSSB to remove debris and miscellaneous structures from the vicinity of NASA Island that could serve as avian predator perches, and eliminate potential access routes that could provide mammalian predators with entry into the colony.
		✓	By 2014, coordinate with NWSSB to remove the drop tower located to the west of 7th Street to eliminate perching opportunities for avian predators.

Objective 1.2*: *Light-footed Clapper Rail
Between 2010 and 2025, support an average of 30 pairs of light-footed clapper rails annually within the Refuge's 740-acre marsh habitat in Anaheim Bay.

Rationale: The substantial loss of wetlands along the California coast is the primary cause for the drastic decline in the light-footed clapper rail population, although other factors such as predation by raptors and mammals have also contributed to this decline. The primary objective of the Light-footed Clapper Rail Recovery Plan (*USFWS 1985b*) is to increase the breeding population of this species by preserving, restoring, and/or creating adequately protected, suitably managed wetland habitat consisting of at least 50 percent marsh vegetation. The proposed action includes proposals to restore and enhance habitat on the Refuge to support the light-footed clapper rail.

Implementing these proposals would support the Recovery Plan's primary objective. Between 1980 and 2008, the estimated number of light-footed clapper rail pairs has varied significantly with five pairs recorded in 1986 to 66 pairs recorded in 1994 (*Zembal et al. 2006*). The highest number of pairs recorded between 2000 and 2008 has been 24 (*Zembal et al. 2006 and Hoffman 2009*). In 2008, approximately 17 breeding pairs of rails were present on the Refuge (*Hoffman 2009*). Several strategies have been incorporated into the proposed actions that are intended to improve habitat quality for rails and subsequently increase the number of pairs present on the Refuge.

Objective 1.2 - Light-footed Clapper Rail *Comparison by Alternative*			
Alternative			
A	B	C	Strategy
✓	✓	✓	Conduct predator management in accordance with the approved *Endangered Species Management and Protection Plan* to reduce the loss of light-footed clapper rail adults, chicks, and eggs to avian and mammalian predators.
✓	✓	✓	Restrict human access to clapper rail nesting areas during the nesting season.

Objective 1.2 - Light-footed Clapper Rail (continued) *Comparison by Alternative*			
Alternative			
A	**B**	**C**	*Strategy*
✓	✓	✓	In partnership with NWSSB, conduct monthly monitoring of clapper rail nests during the nesting season; spring clapper rail call counts; and fall high tide clapper rail counts.
✓	✓	✓	Work with partners to improve the design of clapper rail nesting platforms with the goal of reducing the potential for predator perching, increasing the stability of the platform during strong wind and/or water events, and increasing the long term durability of the structure.
	✓	✓	By 2015, identify funding for and implement a study to evaluate the current conditions (e.g., site elevation, variability in tidal elevation, salinity, plant height and density) in areas of the Refuge that support cordgrass vegetation.
	✓	✓	Over the next five years, coordinate with NWSSB to remove or otherwise address potential avian predator perches located near rail habitat.
	✓	✓	Maintain in good repair at least 80 nesting platforms within the marsh.
	✓	✓	Protect and study the overall nesting and fledgling success of those areas within the marsh where rails are nesting in native vegetation, rather than on nesting platforms.
		✓	By 2014, coordinate with NWSSB to remove the drop tower located to the west of 7th Street that provides perching opportunities for potential avian predators.
		✓	By 2020, identify funding for and implement: 1) a pilot project that would raise the elevation in a portion of the cordgrass-dominated salt marsh habitat on the Refuge and 2) a post-construction monitoring plan to elevate the effects of raising the marsh plain elevation on cordgrass health and vigor.
		✓	Continue to work with the Clapper Rail Recovery Team to release captive bred light-footed clapper rails on the Refuge as appropriate to increase genetic diversity within the rail population on the Refuge.

***Objective 1.3*: Establish Salt Marsh Bird's-Beak on the Refuge**
Within five years of CCP approval, develop and initiate a plan to establish on the Refuge at least one self-sustaining population of salt marsh bird's-beak, consisting of approximately 200 individuals within ten years of planting.

Rationale: The occurrence of salt marsh bird's-beak along the coast of southern California has decreased significantly over the past 60 years as a result of the extensive alteration and filling of wetlands. Historical records indicate that colonies of salt marsh bird's-beak were present in 18 southern California marshes (*Parsons and Zedler 1997, USFWS 1985c*); however, today this species, which was listed as endangered in 1970, is only known from six general areas within its historic range. The high marsh habitat around Anaheim Bay is believed to be one of the 18 marshes that historically supported this species.

Although a previous attempt to reestablish salt marsh bird's-beak on the Refuge in the 1980s was unsuccessful, it is believed that with changes in conditions and new information about the factors

affecting reestablishment of this plant, there is now a greater potential for its successful establishment at this location. The *Salt Marsh Bird's-beak Recovery Plan (USFWS 1985c)* identifies the establishment of self-sustaining populations of this species within its historic range as essential to the recovery of this species.

Objective 1.3 - Establish Salt Marsh Bird's-Beak on the Refuge ***Comparison by Alternative***			
Alternative			
A	**B**	**C**	*Strategy*
		✓	Within five years of CCP approval, identify areas on the Refuge with suitable site conditions (e.g., appropriate site elevation, presence of host plants, nutrient and periodic freshwater inflows, pollinators, ongoing canopy disturbance) for supporting seed germination and seedling establishment and design and implement a plan to attempt to establish salt marsh bird's-beak in these areas.

***Objective 1.4*: Protect Access into the Refuge's Open Water Areas for Sea Turtles**
Throughout the life of the CCP, ensure that appropriate measures are incorporated into any restoration or enhancement project to facilitate continued unobstructed access into the open water areas within Perimeter Pond and 7th Street Pond for visiting sea turtles.

Rationale: In recent years, small groups of east Pacific green turtles has been observed on the Refuge, generally in the vicinity of the 7th Street Pond and the channel that extends from Anaheim Bay into the 7th Street Pond. These areas provide the turtles with opportunities for foraging and resting in the absence of any human disturbance. The turtles are entering the 7th Street Pond despite the presence of a large drainage culvert that provides a connection between the pond and the bay. Plans to restore the area to the southeast of this culvert could include a redesign of the existing culvert to reduce ongoing erosion to surrounding areas caused by high water velocities during ebb tides. To ensure continued safe access into 7th Street Pond and Perimeter Pond for sea turtles, future restoration and enhancement plans will be designed to address the ingress and egress requirements of sea turtles.

Objective 1.4 - Protect Access for Sea Turtles on the Refuge ***Comparison by Alternative***			
Alternative			
A	**B**	**C**	*Strategy*
✓			Maintain the culverts in the vicinity of the 7th Street Pond to ensure maximum clearance for sea turtle ingress and egress.
	✓	✓	Design future restoration and enhancement project s in a manner that will not impede sea turtle ingress and egress into the 7th Street Pond or Perimeter Pond.

***Objective 1.5*: Belding's Savannah Sparrow**
Continue current management strategies to annually support a minimum of 250 Belding's savannah sparrow territories within the Refuge.

Rationale: Belding's savannah sparrow is one of the few bird species that occupies southern California coastal salt marsh habitat year round. As a result, this species has been particularly impacted by the loss of salt marsh habitat throughout the region. Loss of habitat combined with

increased human impacts to the remaining salt marsh habitat resulted in significant reductions in the species' population and ultimately to its listing as endangered by the State of California in 1974.

Since the time of its listing, Belding's savannah sparrow population estimates in California have been increasing with 1,084 pairs present in 1973, 2,274 pairs in 1986, 2,350 pairs in 1996, and 3,372 in 2010 (*Zembal and Hoffman 2010*). However, statewide censuses of Belding's savannah sparrows reveal wide fluctuations in local population sizes, with local extirpations occurring in some years. Since 1996, the Seal Beach NWR has supported relatively large numbers of Belding's savannah sparrow territories. The largest number of territories on the Refuge to date were recorded in 2010, when 326 territories were recorded, the second largest number of Belding's savannah sparrow territories in California (*Zembal and Hoffman 2010*).

Objective 1.5 - Belding's Savannah Sparrow ***Comparison by Alternative***			
Alternative			
A	**B**	**C**	*Strategy*
✓	✓	✓	Minimize human disturbance during the nesting season in habitat known to support Belding's savannah sparrows.
✓	✓	✓	Continue to maintain muted tidal flows within the Bolsa Cell to protect Belding's savannah sparrow habitat.
	✓	✓	Belding's savannah sparrow habitat present around the edges of the islands in Case Road Pond will be protected during restoration activities.

***Objective 1.6*: Protect Coastal Habitats to Benefit Listed and Other Species of Concern**
Over the life of the CCP, protect and maintain 875 acres of coastal wetlands and adjacent wetland/upland transition habitat to provide foraging, resting, and nesting habitat to benefit listed and other species of concern.

Rationale: Various conservation planning documents have been prepared that include recommendations for ensuring the conservation of one or more of the coastal dependent species found on the Seal Beach NWR. These recommendations include protecting extensive areas of native habitat to support bird conservation (*Pashley et al. 2000, Brown et al. 2001, Kushlan et al. 2002*). Specific recommendations for habitat protection and management are also included in the California Least Tern and Light-footed Clapper Rail Recovery Plans (*USFWS 1985a and 1985b*), while other recommendations for conserving Birds of Conservation Concern and other species of concern are included in the U.S. Shorebird Conservation Plan (*Brown et al. 2001*), North American Waterbird Conservation Plan (*Kushlan et al. 2002*), and California Wildlife Action Plan (*California Department of Fish and Game 2007*).

Objective 1.6 – Protect Habitat to Benefit List and Other Species of Concern ***Comparison by Alternative***			
Alternative			
A	**B**	**C**	*Strategy*
✓	✓	✓	Continue to protect and maintain the salt marsh complex to the south of Bolsa Avenue.
	✓	✓	By 2013, develop a step-down Habitat Management Plan for the Refuge that incorporates conservation planning recommendations to benefit the Refuge's listed species and other species of concern.

Objective 1.6 – Protect Habitat to Benefit List and Other Species of Concern (continued) *Comparison by Alternative*			
Alternative			
A	**B**	**C**	*Strategy*
	✓	✓	By 2014, implement directed searches for tiger beetles on the Refuge.
		✓	If direct searches identify the presence of sensitive tiger beetle populations on the Refuge, by 2015, prepare and implement a step-down tiger beetle management and monitoring plan for the Refuge.

Goal 2: Protect, manage, enhance, and restore coastal wetland and upland habitats to benefit migratory birds, as well as other native fish, wildlife, and plant species.

***Objective 2.1*: Baseline Data for Species Presence and Relative Abundance on the Refuge**
Obtain baseline data on species composition and relative abundance for fish, bird, wildlife, and plant species supported within the Refuge's various coastal habitats within two years of the CCP's approval. Data will meet the minimum statistical standard of being within 20 percent of the mean at the 80 percent confidence level.

Rationale: To effectively manage the diversity of resources present within the Refuge's coastal wetland habitats, it is important to update our existing knowledge of refuge species. Once the baseline data has been compiled, habitat monitoring can be implemented to detect changes over time (e.g., changes in vegetative structure and/or composition, changes in bird species composition and/or abundance) due to factors such as sea level rise, climate change, and/or invasion by exotic species.

Objective 2.1 - Baseline Data of Species Presence and Relative Abundance *Comparison by Alternative*			
Alternative			
A	**B**	**C**	*Strategy*
	✓	✓	By 2012, compile all existing survey data for Refuge species composition and relative abundance; identify data gaps, and develop survey plans to obtain data for those species that are not adequately addressed in the existing database.
	✓	✓	By 2013, complete all additional surveys deem necessary to supplement the existing species data available for the Refuge.

***Objective 2.2*: Climate Change and Sea Level Rise**
Within ten years of CCP approval, complete a general assessment of the anticipated changes over the next 25 years in the current distribution and structure (canopy cover and height) of the intertidal habitats within Anaheim Bay, and identify the potential impacts to the wildlife species supported by these habitats as a result of anticipated changes.

Rationale: Scientific evidence acknowledges that world climate is changing (*Bierbaum et al. 2007*) as indicated by increases in global surface temperature, altered precipitation patterns, warming of the oceans, sea level rise, increases in storm intensity, and changes in ocean pH. This is significant because "climate is a dominant factor influencing the distributions, structures, functions and services of ecosystems" (*CCSP 2008*). Climate change (defined as any change in climate over time, whether due to natural variability or as a result of human activity (*CCSP 2008*)) can interact with

other environmental changes to affect biodiversity and the future condition of ecosystems. It is, therefore, essential to understand how these changes are and will continue to impact existing resources, and to develop strategies for protecting affected resources. The extent to which these resources are affected will depend on how and at what rate conditions such as temperature, precipitation, and tidal elevations change over time, the degree of sensitivity of the ecosystem to the climate change, and the availability of adaptation options for effective management responses.

Objective 2.2 - Climate Change and Sea Level Rise ***Comparison by Alternative***			
Alternative			
A	**B**	**C**	*Strategy*
	✓	✓	By 2015, develop and implement a study to update previous subsidence studies conducted in Anaheim Bay to determine if high water levels relative to current marsh vegetation are being influenced by ground subsidence.
	✓	✓	By 2016, implement a seasonal monitoring program to document changes in tidal elevations over time during spring and neap tide events in areas of restricted and unrestricted tidal flow.
	✓	✓	By 2018, complete a general assessment of the anticipated future condition and distribution of tidal marsh plant communities within Anaheim Bay over the next 25 years, document the potential impacts to currently supported wildlife species, and identify those species and habitats most vulnerable to climate change and /or sea level rise.
	✓	✓	By 2020, develop the most reasonable adaption strategies for the species and habitats identified as most vulnerable to climate change/sea level rise.
	✓	✓	By 2022, develop an adaptive management framework for the highest priority conservation targets (species and habitats) and as part of this framework, identify the desired future state of the conservation targets and the alternative strategies for achieving this future state. Finally, design an approach for determining the effectiveness of these alternative strategies that focuses on monitoring outcomes.

***Objective 2.3*: Control Invasive Non-native Upland Plant Species**
Using an integrated approach to pest management, increase native upland plant species richness along the upland areas that border the marsh by at least 30 percent and reduce non-native, invasive upland plants to less than five percent cover over the next 15 years.

Rationale: Although a few upland areas on the Refuge have been restored to native upland habitat, other portions remain dominated by invasive, non-native weedy plants that provide minimum cover for native species. Controlling non-native upland plants along the boundaries of the Refuge's coastal salt marsh habitat, followed by the planting of appropriate upland native plants in the controlled areas would provide new opportunities for secretive marsh and other wetland-dependent bird species to find cover during extreme high tides, while also providing habitat for a variety of upland species. Additionally, native upland vegetation can benefit native pollinators essential to the reestablishment of salt marsh bird's-beak.

Objective 2.3 - Control Invasive, Non-Native Upland Plant Species *Comparison by Alternative*			
Alternative			*Strategy*
A	**B**	**C**	
✓	✓	✓	Monitor and maintain native plant restoration areas near Hog Island and along Kitts Highway, Bolsa Avenue, and Case Road to ensure that these areas are not reinvaded with invasive non-native plants.
	✓	✓	Beginning in 2012, work with NWSSB to expand invasive plant species control to the areas along existing roadways and agricultural fields that abut the Refuge.
	✓	✓	Address the prevention, detection, and management of native and nonnative pest species through an integrated pest management approach.

Objective 2.4*: *Watershed Management Planning
Coordinate with State and local agencies working on management plans for watersheds affecting this Refuge and assist in developing measures that would restore and protect the habitat quality of the Refuge's 945 acres of coastal wetlands.

Rationale: The storm water and urban runoff that flows into Anaheim Bay originates from throughout the watershed, traveling across a variety of jurisdictional boundaries. Water quality is influenced by numerous land use practices; practices that may be regulated differently in each jurisdiction. To account for these differences, efforts to implement effective measures for improving and protecting water quality throughout the watershed must be addressed at the regional level. One such regional effort is the development and implementation of the Watershed Management Area Integrated Regional Water Management Plan Comprehensive Management Plan for North Orange County (*Orange County Watersheds Program 2008*). An objective of this plan is the protection and improvement of surface water quality in the rivers, streams, harbors and channels within the North Orange County Watershed Management Area to reduce impacts on these systems and their receiving waters. Taking an active role in this and other regional watershed planning efforts would help to ensure that regional water quality control efforts will continue to address water quality issues in the waterways that flow onto the Refuge.

Objective 2.4 - Watershed Management Planning *Comparison by Alternative*			
Alternative			
A	**B**	**C**	*Strategy*
✓	✓	✓	Participate in the development and implementation of those watershed management plans that address watersheds that could influence habitat quality within Anaheim Bay.
	✓	✓	Within five years of CCP approval, seek funding to model the amount and quality of water that reaches the primary marsh habitat in Anaheim Bay from the Bolsa Chica and Wintersberg channels, and to conduct associated water quality analyses of these flows to better understand the levels of pollutants entering the Refuge from these sources.

Objective 2.5*: *Restore Coastal Wetland and Wetland/Upland Transitional Habitats
When funding is identified, restore approximately 14 acres of disturbed upland located to the north of the Case Road Pond to wetland and wetland/upland transitional habitat and approximately 10 acres of disturbed upland located to the southeast and west of the 7th Street Pond to wetland and wetland/upland transition habitat.

Rationale: It is estimated that 40 percent of the wetland acreage in Anaheim Bay has been lost to development and agricultural uses. Even greater losses have occurred in the adjacent Huntington Harbor area (*USFWS and CDFG 1976*). Statewide, 80 percent of California's coastal wetlands have been converted to urban or agricultural use (*USFWS 1999*). This significant loss in coastal wetland habitat has led to a decline in several native species that are now federally-listed as threatened or endangered. The loss of these wetlands also represents a significant loss in habitat for many species of migratory shorebirds (*Hickey et al. 2003*).

This objective is also consistent with the principles of landscape ecology, as described under Objective 2.4, and would adhere to Service policy mandating that habitats be managed to maintain and restore biological integrity, diversity, environmental health. Where historic habitat has been lost or severely degraded, we are encouraged to restore these habitats where it is feasible and supports the fulfillment of refuge purposes. Restoration of these habitats would also support the Service's congressional mandate to preserve, restore, and enhance natural habitats for threatened and endangered species, migratory and resident birds, wildlife, and plants; the recovery actions recommended for the light-footed clapper rail; and actions recommended in the Southern Pacific Shorebird Conservation Plan (*Hickey et al. 2003*) to support migratory birds.

Objective 2.5 - Restore Tidal Wetlands ***Comparison by Alternative***			
Alternative			
A	**B**	**C**	*Strategy*
	✓	✓	By 2015, seek funding to prepare and implement restoration plans for the nine acres of disturbed habitat located to the southeast of 7th Street Pond.
	✓	✓	By 2017, seek funding to prepare and implement restoration plans for the 22 acres of disturbed habitat located to the north of the Case Road Pond.
	✓	✓	Following the completion of initial restoration efforts to the north of the Case Road Pond and to the southeast of 7th Street Pond, develop and implement a monitoring program to document natural recruitment of intertidal vegetation and fish and wildlife response to restoration.
		✓	By 2014, coordinate with NWSSB to remove the drop tower and surrounding structures along the west side of 7th Street to facilitate restoration.
	✓	✓	By 2017, prepare and implement restoration plans for the five acres of disturbed habitat located to the west of the 7th Street Pond.

***Objective 2.6*: Restore Native Upland Habitat**
When funding is identified, restore a minimum of ten acres of appropriate native upland habitat in areas of existing disturbed upland habitat to achieve at least 50 percent coverage of native perennial species such as California buckwheat, California sagebrush, coast sunflower, and coastal goldenbush.

Rationale: The native upland habitat that once existed around the perimeter of Anaheim Bay has been all but lost to agricultural, urban development, and military uses. This habitat once provided important cover for wetland dependent birds during extreme high tides. In addition to providing cover for birds and other wildlife, native upland vegetation also attracts native pollinators and assists in the stabilization of soils located adjacent to wetland area. Restoring native upland habitat in proximity the Refuge's salt marsh complex would improve overall habitat quality for Refuge trust species.

Objective 2.6 - Restore Native Uplands *Comparison by Alternative*			
Alternative			
A	B	C	*Strategy*
✓	✓	✓	Continue to plant native upland vegetation in areas of the Refuge where nonnative, invasive vegetation is actively being controlled.
		✓	As part of the restoration plan for the area located to the north of Case Road Pond, include approximately eight acres of native upland habitat restoration along the northern most portion of this area.
		✓	As part of the restoration plan for the area located to southeast of 7th Street Pond, include approximately three acres of native upland habitat restoration along the eastern edge of this area.

***Objective 2.7*: Protect and Enhance Habitat for Fish and Other Marine Organisms**
Protect the habitat quality within the Refuge's 740 acres of regular, unobstructed tidal area, maintain adequate tidal flows within an additional 160 acres of restored subtidal and intertidal habitat, and enhance habitat quality for marine organisms.

Rationale: The Improvement Act requires the maintenance of the Refuge System's biological integrity, diversity, and environmental health. This is best achieved by applying the principles of landscape ecology to Refuge management. Landscape ecology is a sub-discipline of ecology, which focuses on spatial relationships and interactions between patterns and processes. This emerging science integrates hydrology, geology, geomorphology, soil science, vegetation science, wildlife science, economics, sociology, law, engineering and land use planning to conserve, enhance, restore and protect the sustainability of ecosystems.

Over time, natural patterns of climate, hydrology, geology, soils, vegetation, and wildlife resulted in a rich natural diversity. Human cultural practices associated with modern civilization have greatly altered natural physical processes, resulting in declining biological diversity. This is evident in the areas around the Seal Beach NWR, where vast areas of historic salt marsh have been filled to first accommodate farming and later accommodate urban development, and where substantial portions of the area's major rivers have been channelized in an attempt to address flooding concerns. As a result of these losses of natural habitat and changes in the natural patterns of hydrology, it is that much more important to preserve and manage the relatively undisturbed, natural habitats that remain within the current landscape.

Anaheim Bay and its associated native wetland habitats provide important resources for a wide variety of organisms including listed birds such as the California least tern and commercially important fisheries such as California halibut and spotted sand bass. The invertebrate fauna is also an important component of the Refuge's salt marsh ecosystem. The loss of wetland areas throughout California has adversely affected a range of coastal dependent species, therefore, it is essential that what remains of these habitats be maintained in a manner that will protect and sustain the long-term health of these coastal habitats, as well as the organisms these habitats support.

Objective 2.7 - Protect and Enhance Habitat for Fish and Other Marine Organisms *Comparison by Alternative*			
Alternative			
A	**B**	**C**	*Strategy*
✓	✓	✓	Monitor the condition of and maintain in good repair the culverts on the Refuge that facilitate adequate tidal exchange in restored and natural wetland areas.
✓	✓	✓	Support NWSSB in its efforts to periodically assess the health of the eelgrass beds throughout Anaheim Bay and work with researchers and other interested parties to identify opportunities for expanding and/or improving the health of these eelgrass beds within the Refuge.
	✓	✓	Based on the result of site-specific hydrological studies, design and install a new water control structure within the western levee of the Bolsa Cell to allow for better regulation of tidal flows into and out of the Bolsa Cell.
	✓	✓	By 2015, implement a five-year water quality monitoring program (with basic physical parameters such as water temperature, dissolved oxygen, water salinity, pH, light attenuation, turbidity, and levels of inorganic nitrogen and phosphorus) in Anaheim Bay that includes first flush monitoring of runoff entering the Refuge from adjacent drainage channels, as well as regular quarterly monitoring at pre-designated tide cycles and sample locations throughout the Refuge.
	✓	✓	Seek funding to update existing baseline data for fish and marine invertebrate distribution and abundance within the marsh complex, and follow this up with surveys every three to five years to identify any changes in species diversity or abundance.
	✓	✓	By 2012, design and implement a five-year water quality monitoring program for the main marsh complex, as well as the 160 acres of restored tidal habitat at the north end of the Refuge.
	✓	✓	In partnership with NWSSB, establish a regular program to monitor subtidal areas in Anaheim Bay for the invasive marine algae, *Caulerpa taxifolia,* and if detected take immediate action to aggressively contain and eradicate it from the area.
		✓	By 2015, install one or more underwater structures in appropriate areas within the Refuge to provide shelter for a variety of marine organisms and establish a monitoring program to determine if these structures are providing benefits to fish and other marine organisms.

Objective 2.8*: *Migratory Birds
Ensure the continued availability of approximately 900 acres of foraging habitat throughout the Refuge to support the current diversity and abundance of shorebirds and other migratory birds within the Refuge, expand areas suitable for high tide roosting by restoring approximately 11 acres of coastal sage scrub habitat, one acre of salt pan habitat, and nine acres of wetland/upland transition habitat, and restore approximately 15 acres of disturbed upland to tidally influenced salt marsh habitat.

Rationale: Shorebirds represent a significant proportion of bird use within this Refuge throughout the year. Many of these shorebirds are identified as either Birds of Conservation Concern (*USFWS 2002b*) or considered highly imperiled or of high conservation concern by the U.S. Shorebird Conservation Plan (*2004*). Due to the extensive loss of historical foraging habitat

for migratory birds throughout California, it is imperative that the remaining wetlands be protected, enhanced, and where possible expanded through restoration to ensure the continued availability of adequate foraging habitat for the range of species that travel along the Pacific Flyway.

Objective 2.8 - Migratory Birds ***Comparison by Alternative***			
Alternative			
A	**B**	**C**	*Strategy*
✓	✓	✓	Continue to conduct monthly high and low tide bird counts throughout the Refuge.
✓	✓	✓	Minimize disturbance to shorebird foraging, loafing, and nesting habitat throughout the year.
	✓	✓	Beginning in 2015, annually conduct surveys of bird use on the islands within the Case Road and 7th Street Ponds and use this information to better manage the habitats on these islands to support migratory birds.
	✓	✓	By 2015, seek funding to prepare and implement restoration plans for the nine acres of disturbed habitat located to the southeast of 7th Street Pond.
	✓	✓	By 2017, seek funding to prepare and implement restoration plans for the 22 acres of disturbed habitat located to the north of the Case Road Pond.
	✓	✓	By 2017, prepare and implement restoration plans for the five acres of disturbed habitat located to the west of the 7th Street Pond.
		✓	Work with NWSSB to provide foraging opportunities for wintering waterfowl within the agricultural fields that surround the Refuge.
		✓	By 2012, remove the invasive weeds from the tops of the four mounds on the easternmost island in the Case Road Pond and place six to eight inches of clean sand on top of the mounds to support tern, avocet, and/or black-necked stilt nesting on this island.

Goal 3: Enhance public appreciation, understanding, and enjoyment of the Refuge's biological and cultural resources through outreach opportunities and quality wildlife-dependent recreation, including wildlife observation, environmental education, and interpretation.

***Objective 3.1*: Connecting People with Nature**
In partnership with the Friends of Seal Beach and NWSSB, by 2015 conduct a minimum of four events focused on connecting families with nature each year. In addition, continue to conduct or participate in other activities that reach 1,000 people annually on the Refuge and another 3,000 people annually at off-refuge events.

Rationale: Research shows that children are suffering from too much time inside, with children spending an average of 6.5 hours a day with electronics (e.g., television, computers, video games). If a child is raised with little or no connection to nature, they may miss out on the many health benefits of playing outdoors. Studies show that children's health is declining. Childhood obesity rates are increasing, as are the number of children taking prescription medications to treat Attention Deficit Hyperactivity Disorder (ADHD) and depression. Fortunately, research also shows that connecting children and families with nature can provide positive benefits leading to

improved physical and mental health. Being out in nature can improve student learning and can build strong family bonds.

A connection with nature also helps children develop positive attitudes and behaviors towards the environment. Positive interactions with the environment can lead to a life-long interest in enjoying and preserving nature. In fact, in 2007, the Service declared that "connecting people with nature" is among the agency's highest national priorities.

Objective 3.1 - Connecting People with Nature ***Comparison by Alternative***			
Alternative			
A	**B**	**C**	*Strategy*
✓	✓	✓	Continue to support the Friends with their participation in off-refuge events.
		✓	In partnership with the Friends and NWSSB, incorporate a connecting people with nature theme into one of the many special events (e.g., National Public Lands Day, Refuge Week) held on the Refuge.
		✓	Each year, host two activities, involving 20 to 25 people who might not normally come to the Refuge, so they can experience their activity in a nature setting. Activities may include a nature related scavenger hunt for after-school groups, a tour of the nature garden for local garden clubs, and watercolor painting sessions for senior's groups.

***Objective 3.2*: Wildlife Observation**
By 2012, improve wildlife observation opportunities on the Refuge through the installation of an elevated observation platform, enabling more than 1,000 visitors annually to enjoy more of the sights and sounds of the salt marsh habitat, without comprising habitat quality or the mission of NWSSB.

Rationale: To comply with the mission of NWSSB, many of the uses available on other refuges in the NWRS are not possible to implement on this Refuge. Wildlife observation, which is one of the six priority public uses of the NWRS, is one use that can be implemented during supervised visits to the Refuge. As a priority public use, wildlife observation provides the Refuge with a tool to promote a broader public understanding of the value of natural resources and the need to conserve habitat and wildlife. Visitors to the Seal Beach NWR are drawn by the opportunities available to observe the Refuge's diverse array of migratory birds. Others visit in hopes of catching a glimpse of the elusive light-footed clapper rails that live on the Refuge year round. Currently, the best viewing areas require driving the public from Refuge headquarters to various places on the Refuge. Unfortunately, the number of people that can be transported around the Refuge is limited by the number of vans available for this use. The construction of an observation platform within walking distance from the Refuge headquarters would significantly improve the public's opportunity to observe the diversity of migratory birds that visit the Refuge, particularly during scheduled monthly tours. To get our message out and connect new visitors with nature, every effort should be made to facilitate opportunities for wildlife observation when it can be provided without compromising wildlife and habitat values or the mission of NWSSB.

Objective 3.2 - Wildlife Observation *Comparison by Alternative*			
Alternative			
A	**B**	**C**	*Strategy*
✓	✓	✓	Continue to provide opportunities for wildlife observation by maintaining in good condition the 0.6-mile interpretive trail system that extends from the native plant garden to Bolsa Avenue and on out to an observation deck.
✓	✓	✓	Continue to provide opportunities for wildlife observation by conducting regularly scheduled monthly tours, special group tours, and periodic special bird watching outings for interested groups and organizations.
		✓	Expand opportunities for wildlife observation by constructing an elevated observation platform within walking distance of the Refuge headquarters.
		✓	By 2015, install video cameras in the least tern nesting area and/or the marsh to provide live images, available for viewing at the Refuge and possibly on-line, of the activities occurring in these areas.

Objective 3.3*: *Environmental Interpretation
When funding is available, design and implement in partnership with NWSSB an expanded environmental interpretation program for the Refuge that will address multiple topics to reach a broad sector of the community.

Rationale: The Seal Beach NWR, which is situated within a highly urbanized metropolitan area, provides an excellent opportunity for visitors to escape the urban environment and experience the natural coastal resources that once dominated the southern California coastline. The Refuge's proximity to this urban area also provides the opportunity to interpret the mission of the NWRS and the many resources found on the Refuge. Interpretation should be expanded to more thoroughly address the Refuge's full array of natural and cultural resources. Interpretive elements related to early Native American activities around Anaheim Bay are extremely limited. There is also a need within the Refuge Complex to identify innovative ways to reach new and non-traditional audiences through expanded partnerships, special events, and off-site programs.

Objective 3.3 - Environmental Interpretation *Comparison by Alternative*			
Alternative			
A	**B**	**C**	*Strategy*
✓	✓	✓	Continue to maintain the existing interpretive elements provided along the 0.6-mile trail that connects the native plant garden to the observation deck.
		✓	By 2015, develop a comprehensive interpretive video that will be shown in the visitor contact station during monthly tours of the Refuge.
		✓	Design/install additional interpretive elements on the Refuge to showcase the fish, wildlife, and plant species supported on the Refuge, and interpret the history of the area and its importance to native cultures.

Objective 3.4*: *Environmental Education
In partnership with the Friends of Seal Beach, continue to provide opportunities for environmental education both on- and off-Refuge to reach 500 students annually.

Rationale: Environmental education activities are essential to implementing the purposes of the Refuge and the mission of the NWRS. They also assist in getting children connected with nature.

The Friends of Seal Beach have developed a number of opportunities for partnering with others to implement environmental education programs that are conducted both on and off the Refuge. The San Diego NWR Complex will continue to provide the Friends with the support they need to implement these important activities.

Objective 3.4 - Environmental Education ***Comparison by Alternative***			
Alternative			
A	**B**	**C**	*Strategy*
✓	✓	✓	Continue to provide support to the Friends in their efforts to implement environmental education activities both on and off-refuge, in-classroom instruction, and special school outings on the Refuge that enable teachers to conduct curriculum standards-based activities in an outdoor setting.
✓	✓	✓	Continue the current traveling library display program that showcases the wildlife found on the Refuge.

Objective 3.5*: *Cultural Resource Program
Implement proactive management of cultural resources that focuses on meeting the requirements of the National Historic Preservation Act, including consultation, identification, inventory, evaluation, and protection of cultural resources.

Rationale: It is the policy of the Service to identify, protect, and manage cultural resources located on Service lands and affected by Service undertakings. Cultural resources connect us to our past, providing the means to study and reflect upon the events and processes that have shaped our nation, our communities and ourselves. Their true value rests in what they offer us in terms of scientific information, interpretive opportunities, and cultural identity. Cultural resources can provide important information about changes to our environment and landscapes over thousands of years. This information contributes directly to the Service's primary mission of managing wildlife and natural landscapes. Interpretation of cultural resources provides the Service with the opportunity to educate refuge visitors about how humans interact with their natural environment and changes to landscapes over time.

Objective 3.5 - Cultural Resource Program ***Comparison by Alternative***			
Alternative			
A	**B**	**C**	*Strategy*
✓	✓	✓	Comply with all applicable cultural resource regulations and policies prior to implementing projects that would disturb any surface or subsurface cultural resources.
✓	✓	✓	Create and utilize a Memorandum of Understanding with Native American groups to implement the inadvertent discovery clause of the Native American Graves Protection and Repatriation Act (NAGPRA).
	✓	✓	Seek funding to protect an existing cultural resource on the Refuge.
	✓	✓	Design and implement a native plant area and interpretive program that focus on past Native American land use practices on the Refuge; design of these interpretive elements would be coordinated with federally recognized Tribes and other interested parties.

Goal 4: Further strengthen the management partnerships between the Seal Beach National Wildlife Refuge and Naval Weapons Station Seal Beach, while preserving our respective missions.

Objective 4.1*: *Effective Interaction to Preserve Respective Missions
Preserve the mission of the NWRS and the goals of the Seal Beach NWR, as well as the mission of NWSSB, through effective communication, coordination, and collaboration between the Service and the Navy.

Rationale: The Seal Beach NWR was established by Congress to be administered by the Service in accordance with Refuge policy, but also pursuant to plans which are mutually acceptable to the Secretary of the Interior and the Secretary of the Navy. To achieve the missions of both the Service and the Navy necessarily requires a fully functional partnership. Although the missions of both agencies differ, the mandates for protecting natural and cultural resources are very similar, and the proposals included within the CCP are intended to be compatible with the proposals included in the INRMP for NWSSB. It is through close communication and coordination that the management proposals established by each agency can be must effectively implemented.

Objective 4.1 - Effective Interaction to Preserve Respective Missions ***Comparison by Alternative***			
Alternative			
A	**B**	**C**	*Strategy*
✓	✓	✓	Continue to inform appropriate departments at NWSSB of potential projects and activities on the Refuge that may affect station operations and coordinate with NWSSB on implementation actions.
✓	✓	✓	Finalize a Memorandum of Understanding between the Service and the Navy on management actions affecting the Refuge and the Naval Weapons Station.
✓	✓	✓	Continue to work with NWSSB to resolve conflicts between the activities on the small arms range and endangered species management on the Refuge.

6.3 Monitoring

Monitoring the effects of management actions on the Refuge's trust resources is an important component of the CCP, as is the documentation of the Refuge's baseline conditions. By completing baseline inventories and monitoring specific management actions, Refuge staff can better understand the species, habitats, and physical processes that occur on the Refuge and the ecological interactions that occur between species. Monitoring of federally listed species is an ongoing management activity on the Refuge that will continue per available funding.

The collection of baseline data for avian species on the Refuge will also continue and partners and funding will be sought to conduct a native plant species inventory for the Refuge and directed searches for native pollinators and tiger beetles, as well as gather additional information about the marine organisms present on the Refuge. Studies related to water quality, sea level rise and climate change will also be conducted per available funding. This data will be used for such things as updating existing species lists and monitoring changes in habitat quality and type. Monitoring will also be conducted to evaluate the effectiveness of the various wildlife and habitat management

strategies proposed in this CCP and to determine if changes in management direction are necessary to achieve Refuge purposes and goals.

Monitoring of public use programs will involve the continued collection of visitor use statistics. The data obtained will then be used to evaluate the effects of public use on Refuge habitat and wildlife populations, as well as to determine if the public use opportunities provided by the Refuge are achieving proposed objectives for improving visitor understanding of Refuge resources, connecting people with nature, and providing a positive visitor experience.

6.4 Adaptive Management

The Service acknowledges that much remains to be learned about the species, habitats, and physical processes that occur on the Refuge, and about the ecological interactions between them. Developing a better understanding of these processes and interactions is further complicated by ongoing changes associated with sea level rise and climate change. Uncertainty is an unavoidable component of managing natural systems because of the inherent variability in these systems and gaps in our knowledge of their functions. Adaptive management involves sequential decision making, integrating project design, management, and monitoring to systematically test assumptions. It strives to reduce some of that uncertainty and improve management over time by allowing us to evaluate and refine management based on the results of management activities and the status of the managed resource. The Service has been practicing adaptive management on the Refuge since its establishment and plans to continue the practice. Accordingly, the proposed management scenario (Alternative C) provides for ongoing adaptive management of the Refuge, such as is described in Objectives 2.2 and 2.3, above.

In designing and implementing the adaptive management strategy for this Refuge, is may be necessary at some point during the next 15 years to amend the CCP in response to changing conditions. Adequate baseline data, clearly defined and measurable project objectives, a monitoring plan focused on measurable results, and a process for refining and improving current and future management actions are all essential components of a successful adaptive management approach. For proposed restoration projects, the details of the adaptive management approach would be integrated into final restoration plans.

The adaptive management process would also be used to evaluate our success in achieving our public use goals and objectives. These periodic evaluations would be used over time to adapt both our public use objectives and strategies to better achieve our goals. Such a system embraces uncertainty, reduces option foreclosure, and provides new information for future decision-making.

6.5 Partnership Opportunities

The primary partners currently assisting in the management of this Refuge include NWSSB and the Friends of Seal Beach NWR. NWSSB contributes funding and/or personnel to assist in various aspects of Refuge management, including, but not limited to, predator management, contaminant assessment and cleanup, clapper rail monitoring, California least tern monitoring and site preparation, monthly public tours of the Refuge, and special events (e.g., volunteer restoration projects, Public Lands Day events). Members of the Friends of Seal Beach NWR volunteer their time to accomplish an enormous amount of work directly related to Refuge management. Contributions include conducting the monthly public tours of the Refuge, conducting special tours, maintaining the Refuge's native plant garden, conducting regular bird counts, assisting in clapper rail monitoring, participating in predator monitoring for nesting California least terns, conducting

public outreach at on- and off-Refuge events, assisting with special events, and conducting general maintenance activities around the Refuge. Other partners have included local Audubon Society chapters, scouting and other youth organizations, local colleges and universities, and the California Waterfowl Association.

Partnerships will likely play an important role in implementing the various strategies presented above. Implementation of the restoration proposals could involve a combination of state and/or federal agencies, such as the California Coastal Conservancy and/or the National Oceanic and Atmospheric Administration (NOAA) Restoration Center, as well as nongovernmental organization partners such as the California Waterfowl Association, who assisted both in the design of the restoration concepts described in the CCP and in preparing grant applications. As the CCP is implemented, the Refuge will seek additional partners to assist in visitor services and public outreach; research, surveys, and monitoring; and addressing regional issues such as water quality.

6.6 Step-down Plans

Some projects such as public use programs and habitat restoration proposals require more in-depth planning than the CCP process is designed to provide. For these projects, the Service prepares step-down plans. Step-down plans provide additional planning and design details necessary to implement the strategies (projects or programs) identified in the CCP. Two step-down plans have been prepared for review as part of this CCP. These include an Integrated Pest Management Plan, provided as Appendix C, and a Mosquito Management Plan, provided as Appendix D. A predator management plan (described in detail in Chapter 3) was prepared and approved for the Refuge in 1991 and will continue to be implemented as part of the approved CCP. Several additional step-down plans are proposed for completion following the approval of the CCP. Table 1 lists these step-down plans along with the target dates for completion.

Table 6-1
Step-down Plans Proposed for the Seal Beach NWR

Plan	*Target for Completion*
Habitat Management Plan	2013
Habitat Restoration Plans for areas around Case Road Pond and 7th Street Pond	2015/2017

Per the Department of the Interior fire management policy, all refuges with vegetation that can sustain fire must have a Fire Management Plan (FMP) that details fire management guidelines for operational procedures and values to be protected and enhanced. The Seal Beach NWR was exempted from this requirement in January 2003 (Appendix G). The reasons for this exemption include the limited availability of burnable vegetation, the lack of ignition sources, a long history of no wildfires, and little chance of human-ignited fire due to restricted public access onto the site and little potential for trespass. Additionally, NWSSB has prepared a comprehensive fire management plan for the NWS that addresses fire protection and suppression activities over the entire facility, including the Refuge. As a result, no step-down fire management plan will be prepared for this Refuge.

6.6.1 Draft Step-Down Plans

Draft Integrated Pest Management Plan

An Integrated Pest Management (IPM) Plan has been developed for the Seal Beach NWR in accordance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 U.S.C. 136r-1) and Part 517 DM 1 of the Department of the Interior's Departmental Manual. The complete document is provided for review in Appendix C.

The purpose of preparing an IPM Plan is to provide a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks. The Service is mandated to manage pests and use IPM principles in a manner that reduces risks from both the pests and associated pest management activities. IPM is a science-based, decision-making process that incorporates management goals, consensus building, research, pest biology, environmental factors, pest detection, monitoring, and the selection of the best available technology to prevent unacceptable levels of pest damage. In developing the IPM Plan, full consideration has been given to the safety and protection of humans and other non-target organisms and resources.

Along with a detailed discussion of IPM techniques, the IPM Plan describes the selective use of pesticides for pest management on the Seal Beach NWR. It also describes the approval process to be followed when pesticides are proposed for use on the Refuge. Depending on the product, Pesticide Use Proposals (PUPs) are submitted for review and approval at the Project Leader, Regional Office, or Washington Office level. Unless an IPM Plan is in place, all PUPs must be submitted for review and approval at the appropriate level on an annual basis. With an approved IPM Plan and Mosquito Management Plan in place for the Seal Beach NWR, PUPs would initially be reviewed and approved at the appropriate level, then for the next four years these PUPs would only need review and approval at the field level. If however the Refuge is proposing a substantial change in the use pattern of an approved PUP, review by the Regional or Washington Office would be required before this change could be implemented on the Refuge.

The primary focus of the IPM Plan for the Seal Beach NWR is on controlling invasive upland plants. The IPM Plan, which will be evaluated for approval as part of the CCP process, will continue to be reviewed and updated as needed to address new information and policy changes.

Draft Mosquito Management Plan

In an effort to address concerns related to mosquito control on refuges and to provide a process for determining if and how to manage mosquito populations within the NWRS, the Service has drafted a Mosquito and Mosquito-Borne Disease Management Policy. The draft policy, which was published in the Federal Register on October 15, 2007 (72FR58321), states that a mosquito management plan is to be prepared for Refuges with current mosquito control or mosquito monitoring programs. Although the Service's mosquito policy has not yet been approved, a Mosquito Management Plan for the Seal Beach NWR has been prepared because mosquito management is already being implemented on the Refuge by the Orange County Vector Control District (OCVCD). The Mosquito Management Plan, which will be evaluated for approval as part of the CCP process, will continue to be reviewed and updated as needed to address new information and policy changes.

Until now, OCVCD has conducted mosquito management under annually approved Refuge Special Use Permits (SUPs). However, future mosquito management on the Refuge will be subject to the conditions included in annually issued SUPs, as well as the guidance and procedures presented in the Mosquito Management Plan, provided as Appendix D of the Seal Beach NWR CCP. This Plan

describes when and how mosquito monitoring, management, and control should be implemented on the Refuge. The Refuge and OCVCD both advocate for an integrated approach to mosquito management that includes a range of tools to improve habitat conditions for estuarine wildlife while reducing threats to public health from mosquito species capable of transmitting disease to humans. It is the intent of the Mosquito Management Plan to further define this approach to mosquito surveillance and control on the Seal Beach NWR.

Because of the nature of mosquito-borne diseases, as well as the limited information available regarding the effects of these diseases on wildlife of the Refuge, the phasing approach presented in the Mosquito Management Plan focuses on the implementation of a mosquito management program to protect human health. The plan presents four different mosquito scenarios for the Refuge, from a condition in which there are relatively low numbers of mosquito larvae present on the Refuge to a situation in which there are significant numbers of adult mosquitoes present on the Refuge during a declared public health emergency related to mosquito-borne disease. Each successive phase includes an expanded approach to addressing the threat to human health associated with specific mosquito conditions on the Refuge. The four phases are summarized below and presented in detailed in the Plan.

Phase 1. In Phase 1, mosquitoes are known to breed on the Refuge, but mosquito threshold treatment levels on the Refuge have not been exceeded during the current breeding season. Under these conditions, mosquito monitoring would be implemented throughout the breeding season.

Phase 2. In Phase 2, mosquitoes are known to breed on the Refuge and the numbers of mosquito larvae present exceed established mosquito larvae threshold treatment levels. Under these conditions, mosquito monitoring would be implemented throughout the breeding season, actions to reduce potential mosquito breeding habitat on the Refuge would be conducted per available funding, and the Refuge Manager would consider the use of compatible mosquito larvae control. The Plan permits the use of Bti, Bs, and Altosid briquets for larvae control.

Phase 3. In Phase 3, mosquitoes are known to breed on the Refuge, the numbers of mosquito larvae in late instar phases and/or pupae present on the Refuge exceed mosquito threshold treatment levels, and the species exceeding these thresholds pose an immediate threat to human health. Under these conditions, mosquito monitoring would be implemented throughout the breeding season, actions to reduce potential mosquito breeding habitat on the Refuge would be conducted per available funding, and the Refuge Manager would consider the use of compatible mosquito larvae and pupae control. The Plan permits the use of monomolecular biodegradable film to control mosquito pupae.

Phase 4. In Phase 4, an adulticide would be considered for application on specific portions of the Refuge if all of the following conditions apply: a public health emergency has been declared by OCHCA or the California Department of Public Health for an area that includes the Refuge, infected mosquitoes have been identified on the Refuge or within the published flight range of breeding areas on the Refuge, and the number of female mosquitoes trapped on the Refuge exceeds established thresholds. The Plan permits the use of adulticides with the active ingredient sumithrin, which includes AquaAnvil and Anvil 10+10 ULV. Use of an adulticide requires prior approval of the product through the PUPs review process and revisions to the SUP.

6.7 Compliance Requirements

6.7.1 Federal Regulations, Executive Orders, and Legislative Acts

All projects and step-down plans described in the CCP will be required to comply with NEPA and the Improvement Act, as well as a variety of other Federal regulations, executive orders, and legislative acts. Federal regulations, executive orders, or legislative acts that may be applicable to projects implemented in this Refuge include:

Human Rights Regulations

Executive Order 12898, Environmental Justice. Federal agencies are mandated to achieve environmental justice by identifying and addressing disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.

Americans with Disabilities Act of 1990 (ADA). Discrimination is prohibited on the basis of disability in employment, State and local government, public accommodations, commercial facilities, transportation, and telecommunications.

Cultural Resources Regulations

Executive Order 11593, Protection and Enhancement of the Cultural Environment. The Service is required to comply with Section 106 of the National Historic Preservation Act of 1966, as amended, by consulting with Federal and State Historic Preservation Officers when development activities are proposed that would affect the archaeological or historical sites.

Executive Order 13007, Indian Sacred Sites. This order provides for access to and ceremonial use of Indian sacred sites on Federal land used by Indian religious practitioners and directs Federal land managers to avoid adversely affecting the physical integrity of such sacred sites.

Antiquities Act of 1906. This act authorizes the scientific investigation of antiquities on Federal land; prohibits and provides penalties for unauthorized search for or collection of artifacts or other objects of scientific interest; and authorizes the president to establish national monuments and cultural areas on Federal lands.

National Historic Preservation Act of 1966, as amended (PL 89-665; 50 STAT 915; 16 USC 470 et seq.: 36 CFR 800) (NHPA). Federal agencies are directed to take into account the effects of their actions on items or sites listed or eligible for listing in the National Register (Section 106). Section 110(a) sets inventory, nomination, protection, and preservation responsibilities for federally owned cultural properties.

American Indian Religious Freedom Act of 1978 (PL 95-341; 92 STAT 469; 42 USC 1996). This act protects and preserves the right of American Indians to believe, express, and exercise their traditional religions, including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.

Archaeological Resources Protection Act of 1979, as amended (PL 96-95; 93 STAT 722; 16 USC 470aa-47011) (ARPA). This Act protects archeological resources on public lands.

Native American Graves Protection and Repatriation Act of 1990 (PL 101-601; 25 USC 3001 et seq.) (NAGPRA). Federal agencies are required to provide information about Native American cultural items (e.g., human remains, funerary objects, sacred objects, and objects of cultural patrimony) to parties with standing, such as lineal descendants, culturally affiliated Indian tribes, or Native Hawaiian organizations, and, upon presentation of a valid request, dispose of or repatriate these objects to them.

Curation of Federally-Owned and Administered Archaeological Collections (36 CFR 79). Federal agencies are responsible for ensuring proper care of federally owned and administered archaeological collections, including ensuring that significant prehistoric and historic artifacts, and associated records, are deposited in an institution with adequate long-term curatorial capabilities. Repositories, whether Federal, State, local, or tribal, must be able to provide professional, systematic, and accountable curatorial services on a long-term basis.

Biological Resources Regulations

Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds. This order instructs Federal agencies to conserve migratory birds by several means, including the incorporation of strategies and recommendations found in Partners in Flight Bird Conservation Plans, The North American Waterfowl Plan, the North American Waterbird Conservation Plan, and the United States Shorebird Conservation Plan, into agency management plans and guidance documents.

Executive Order 13112, Invasive Species. Federal agencies whose actions may affect the status of invasive species are required to use relevant programs and authorities to prevent, control, monitor, and research such species and coordinate complementary, cost-efficient, and effective activities concerning invasive species by relying on existing organizations already in place that address invasive species issues.

Migratory Bird Treaty Act of 1918, as amended (MBTA). This Act provides protection for bird species that migrate across state and international boundaries.

Fish and Wildlife Act of 1956, as amended (16 U.S.C. §§742a-742j, not including 742d-742l). This act provides the Secretary of the Interior with authority to protect and manage fish and wildlife resources and provides direction to administer the act with regard to the inherent right of every citizen and resident to fish for pleasure, enjoyment, and betterment and to maintain and increase public opportunities for recreational use of fish and wildlife resources.

Endangered Species Act of 1973, as amended (16 USC 1531 et seq.) (ESA). This act provides for the conservation of ecosystems upon which threatened and endangered species of fish, wildlife, and plants depend, both through Federal action and by encouraging the establishment of State programs. Section 7 of the ESA requires Federal agencies to insure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of listed species or modify their critical habitat.

Land and Water Use Regulations

Executive Order 11988, Floodplain Management. Federal agencies are prohibited from contributing to the "adverse impacts associated with the occupancy and modification of floodplains" and the "direct or indirect support of floodplain development." In addition, before proposing, conducting, supporting, or allowing an action in a floodplain, each agency

is to determine if planned activities will affect the floodplain and evaluate the potential effects of the intended actions on its functions.

Executive Order 11990, Protection of Wetlands. Each agency shall provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and preserve and enhance the natural and beneficial values of wetlands when conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

Executive Order No. 12996, Management and General Public Use of the National Wildlife Refuge System. This order directs the Secretary of the Interior to recognize compatible wildlife-dependent recreational activities involving hunting, fishing, wildlife observation and photography, and environmental education/interpretation as priority general public uses on the refuge system.

Refuge Recreation Act of 1962, as amended. This act authorized the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use, when such uses do not interfere with the area's primary purposes.

National Wildlife Refuge System Act of 1966, as amended (16 USC 668dd-668ee). This act requires that refuges are managed as a national system of related lands, waters, and interests for the protection and conservation of our Nation's wildlife resources. Any use of a refuge is permitted provided "such uses are compatible with the major purposes for which such areas were established."

Coastal Zone Management Act of 1972 (16 USC 1451-1464). This act requires that all Federal actions proposed in the coastal zone be conducted in a manner consistent with the approved coastal zone management plan.

Federal Water Pollution Control Act of 1948, as amended (33 U.S.C. 1251 - 1376; Chapter 758; P.L. 845; 62 Stat. 1155) (Clean Water Act). This act established the basic structure for regulating discharges of pollutants into the waters of the United States. Section 402 of the act established the National Pollutant Discharge Elimination System (NPDES) to authorize EPA issuance of discharge permits (33 U.S.C. 1342) and Section 404 authorized the U.S. Army, Corps of Engineers to issue permits for the discharge of dredged or fill material into navigable waters at specified disposal sites (33 U.S.C. 1344).

Tribal Coordination

Executive Order 13175, Consultation and Coordination with Indian Tribal Governments. This order requires Federal agencies to implement an accountable process to ensure meaningful and timely input by tribal officials as policies are developed that have tribal implications.

Wilderness Review

Wilderness Act of 1964 (16 U.S.C. 1131-1136, 78 Stat. 890). The Wilderness Act of 1964 directed the Secretary of the Interior, within 10 years, to review every roadless area of 5,000 or more acres and every roadless island (regardless of size) within National Wildlife Refuge and National Park Systems and to recommend to the President the suitability of each such area or island for inclusion in the National Wilderness Preservation System. Refuge planning policy requires a wilderness review concurrent with the CCP process [602 FW 3(1)(c)].

(The Service lands and waters within the Seal Beach NWR have been inventoried and no areas were found that meet the eligibility criteria for a Wilderness Study Area as defined by the Wilderness Act. Therefore, potential wilderness designation of lands and waters within the Seal Beach NWR is not analyzed further in the CCP. The results of the wilderness inventory are documented in Appendix H.)

6.7.2 Potential Future Permit, Approval, and/or Review Requirements

The implementation of some actions described in this CCP may require additional analysis and review under NEPA, particularly those actions associated with future step-down plans or individual projects that are to be described in greater detail in the future. Additionally, prior to implementation of the various management actions, the Service may be required to obtain local, state, or federal permits or approvals. Permits, approvals, or reviews that may be required for projects on this Refuge include:

- **U.S. Fish and Wildlife Service, Refuges** - Project level internal Section 7 consultation, as appropriate under the authorities of the Endangered Species Act, prior to implementing any actions that may affect federally listed endangered or threatened species.

- **U.S. Fish and Wildlife Service, Regional Cultural Resources Team** - Project level internal review of actions that could have an adverse effect on cultural resources pursuant to the National Historic Preservation Act and/or other regulations related to the protection of cultural resources. Compliance involves submitting a Request for Cultural Resource Compliance Form (Appendix I) to the Regional Cultural Resources Team, who will determine if consultation with the California State Historic Preservation Officer is required.

- **U.S. Navy, Naval Weapons Station Seal Beach** – Coordination with the Navy regarding actions proposed on the Refuge, as described in a forthcoming Memorandum of Understanding (MOU). A draft MOU that describes when and to what extent project coordination will occur between the Navy and the Service is currently being reviewed by both parties. The draft MOU defines proposals as falling into one of three categories: actions that require no involvement by the Navy; actions that require informing the Navy of a proposed activity or action; and actions that require concurrence from the Navy. The procedures for communication between parties under these various categories are also described in the draft MOU. Until the MOU is approved, Refuge staff will continue to coordinate with the appropriate departments at NWSSB on activities and actions proposed on the Refuge as described in the General Plan and Management Plan that were prepared in association with Refuge establishment.

- **NOAA, National Marine Fisheries Service** – Project level consultation, as appropriate under the authorities of the Endangered Species Act for any actions that may affect threatened or endangered marine species; and project level consultation, per the requirements of the Magnuson-Stevens Fishery Conservation and Management Act, for any actions that may adversely affect essential fish habitat.

- **U.S. Army Corps of Engineers** - Clean Water Act Section 404 or Rivers and Harbors Act Section 10 Permits for wetland restoration projects or other actions that could discharge dredged or fill material into waters of the U.S. or into navigable waters of the U.S.

- **California State Water Resources Control Board, Santa Ana Region**- Clean Water Act Section 401 certification for discharges into waters of the U.S. and a General Permit for Discharges of Storm Water Associated with Construction Activity.

- **California State Historic Preservation Office** - Section 106 consultations under the authorities of the National Historic Preservation Act for any actions that may affect historic properties or cultural resources associated with listed properties (or those eligible for listing) on the National Register of Historic Places.

- **California Coastal Commission** - Coastal consistency determination in accordance with the federal Coastal Zone Management Act (CZMA) of 1972.

6.7.3 Conservation Measures to be Incorporated into Future Projects

To ensure that the future projects and other actions described in this CCP do not result in significant adverse effects to the environment, conservation measures shall be implemented, as appropriate, in association with the development and/or carrying out of future proposed projects and/or actions. Various conservation measures to be considered are outlined below.

General Conservation Measure for all Project Categories

- Follow all terms and conditions provided in regulatory permits and other official project authorizations or approvals.

Habitat and Species Protection Conservation Measures

- Avoid any disturbance within and provide adequate no disturbance buffers around all nesting areas during the breeding season;
- Minimize disturbance (e.g., noise, lighting, human presence) in sensitive habitat areas year round;
- To the extent feasible, use existing roadways or travel paths for access related to both project implementation and ongoing refuge activities;
- When projects are proposed in subtidal habitat areas, conduct surveys for and map the presence of any eelgrass areas prior to any construction and again following construction to determine the extent, if any, of impact to existing eelgrass beds and based on that information implement mitigation, if appropriate, in accordance with the Southern California Eelgrass Mitigation Policy (adopted July 31, 1991);
- Adhere to the specific BMPs included on pesticide product Chemical Profiles to avoid impacts to Refuge trust species (refer to Appendix C for more details);
- Include in the SUP that is issued annually to the OCVCD the BMPs presented in the Mosquito Management Plan (Appendix D), the stipulations included in the Compatibility Determination for Mosquito Management (Appendix A-3); and any specific BMPs included on the pesticide product Chemical Profiles for mosquito control products;
- Conduct presence/absence surveys for seals, sea lions, and sea turtles prior to any construction activities proposed in areas where these species may be present, monitor for the presence of these species during construction, and/or, if necessary, install appropriate barriers to keep these species out of the restoration area during construction; and
- Consider the potential for seals, sea lions, and/or sea turtles to enter/exit culverts or other water control structures when designing these facilities.

Water Quality Conservation Measures

- Obtain a Construction General Permit (2009-0009-DWQ) from the California State Water Resources Control Board and prepare a Storm Water Pollution Prevention Plan (SWPPP) for any construction or demolition activity or any other activity that results in a land disturbance of equal to or greater than one acre;
- Implement appropriate erosion control measures (e.g., fiber rolls, filter fabric, silt fencing, cofferdams) for any land disturbance that occurs within or adjacent to a wetland or upstream of a storm drain system;
- Fence or otherwise delineate the boundaries of the project to avoid disturbance to surrounding vegetation;
- Carrying out the appropriate BMPs, including those outlined in the IPM and Mosquito Management Plans, when applying pesticides on the Refuge; and
- Implement the following BMPs when construction vehicles or equipment are being used on the Refuge:
    - Specify and follow vehicle and equipment fueling procedures and practices that are designed to minimize or eliminate the discharge of fuel spills and leaks into adjacent wetlands or the storm drain system;
    - To the extent practicable, do not allow vehicle/equipment fueling within 50 feet of a wetland or downstream drainage facility and use berms and/or dikes around fueling areas to prevent run-on, runoff, and to contain spills;
    - Inspect construction vehicles and equipment for leaks prior to each day of use and if a leak is discovered, immediately implement repairs; and
    - Maintain a spill kit on the construction site at all times when construction equipment is present.

Air Quality Conservation Measures

- Effectively stabilize graded or disturbed areas during construction to minimize dust generation by:
    - watering prior to and during any earth movement;
    - watering exposed soil three times per day, as applicable;
    - installing wind fencing, if deemed necessary;
    - stopping work during high wind conditions;
- Cover piles of excavated material with a suitable cover such as a tarp;
- Revegetate disturbed construction sites with appropriated native plant species within one week of project completion;
- Cover the load of all haul vehicles during the transport of dirt or other dust generating materials;
- Wash or swept all construction vehicles and equipment prior to leaving the project site to avoid tracking dirt and dust onto public roads;
- Ensure that all construction equipment meets SCAQMD air quality standards; and
- Carrying out the appropriate BMPs, as outlined in the IPM and Mosquito Management Plans (Appendix C and D), when applying herbicides or pesticides.

6.8 Refuge Operations

The CCP will serve as the primary management reference document for Refuge operations, management, and step-down planning for the next 15 years or until the CCP is formally revised or amended. The Service will implement the final CCP with assistance from existing and new partner agencies and organizations and from the public. The timing and achievement of the management strategies proposed in this document is contingent upon a variety of factors, including funding and

staffing, completion of step-down plans, accomplishing the required compliance requirements, and monitoring outcomes.

Each of these factors is discussed as it applies to the CCP. The CCP provides long-term guidance for management decisions and identifies the Service's best estimate of future needs. These plans detail program planning levels that are sometimes substantially above current budget allocations and, as such, are primarily for Service strategic planning and program prioritization purposes. Accordingly, the plans do not constitute a commitment for staffing increases, operational and maintenance increases, or funding for future land acquisition.

6.8.1 Funding and Staffing

For fiscal year (FY) 2010, the general operating costs (excluding staff costs which are discussed below) for the Seal Beach NWR have been estimated at $43,000. Base funding available to Refuges varies annually. In addition, specific funding may be provided in a given year to address deferred maintenance needs, to fund a specific Refuge construction project, or to address specific management actions. For instance, in FY 2010, $5,000 in additional funding was provided to the Seal Beach NWR for control of invasive plants. Special funding may also be available from time to time through a competitive process initiated to fund special projects, such as visitor services projects that implement the Service's initiative for connecting people with nature.

The annual budget for the Refuge System is not always adequate to address the replacement and maintenance needs on individual Refuges; therefore, a database of deferred maintenance projects is retained as part of the Service Asset Maintenance Management System (SAMMS). The deferred maintenance projects for the Seal Beach NWR include replacement of culverts; removal of concrete debris from the marsh, and replacement of interpretive signs. The SAMMS database also includes new constructions projects. The deferred maintenance projects there were included in the SAMMS database prior to the approval of the CCP totaled approximately $420,000 and the new construction project proposals totaled approximately $1.1 million.

With the completion of the CCP, the SAMMS database will be updated to reflect the proposals included in the preferred management alternative for the Refuge. Table 6-2 presents the proposals that would be included in the SAMMS database if the proposed action, Alternative C, is selected as the preferred alternative. The projects are listed in order of priority for completion.

Another database, the Refuge Operating Needs System (RONS), includes new or expanded funding for projects and staffing to support activities related to plan implementation, attainment of Refuge goals, or satisfying legal mandates. Data within RONS are used regularly in budget justifications presented to the Department of the Interior, the Office of Management and Budget, and Congress. All of the RONS projects within the San Diego NWR Complex, of which the Seal Beach NWR is a part, are prioritized to identify the most important projects within the Complex. Each year RONS projects are submitted for consideration and compete with similar projects throughout the nation for Refuge funds.

Following the completion of the CCP for the Seal Beach NWR, the RONS database will be updated to reflect the proposals included in the preferred management alternative for the Refuge. To illustrate the changes to the RONS database as a result of the approval of the CCP, Table 6-3 presents the proposals include in the proposed action, Alternative C. If this alternative is selected as the preferred alternative, these are the projects that would be included in the updated RONS database. For each project, the corresponding CCP objective, as described in Section 6.2, is also provided. The costs presented in Table 6-3 are rough estimates and will be refined as more details are available. To fully implement the proposed actions and achieve the goals and objectives of the

CCP, additional staff will be necessary, as presented in Table 6-4. The projects listed in Table 6-3 are presented in order of priority (from highest to lowest) within the Refuge.

Table 6-2
Proposed Update to the SAMMS Database
Deferred Maintenance and New Construction Projects
Described in the Proposed Action (Alternative C)

Proposed Capital Improvement Projects (SAMMS) (presented in order of priority)	Corresponding CCP Objective	Operating Costs	
		First Year Cost	Recurring Annual Cost
Install a new water control structure near the center of the western Bolsa Cell levee; remove existing culverts at the southern end of the levee (revises deferred maintenance projects 2009972618 and 2009964689 in Table 6-2)	2.4, 2.7, 2.8	$110,000	$2,000
Restore five-acres of existing weedy vegetation around the margins of the marsh to appropriate native upland habitat	2.6	$14,000	$1,500
Prepare sites appropriate for establishing populations of salt marsh bird's-beak	1.3	$20,000	$1,000
Remove the existing drop tower	1.1, 1.2, 2.5	$50,000	0
Construct a 2,500-square-foot maintenance building adjacent to the existing Refuge headquarters	2.3, 3.1	$300,000	$3,000
Restore 15 acres of disturbed land located to the southeast and west of the 7th Street Pond to a range of native wetland and upland habitats	2.5, 2.6, 2.8	$1,170,000	$2,000
Restore 22 acres of nonnative upland habitat at the north end of the Case Road Pond to a range of native wetland and upland habitats	2.5, 2.6, 2.8	$1,630,000	$1,000
Protect an existing cultural resource on the Refuge by capping the site with clean fill	3.5	$100,000	0
Remove debris and miscellaneous structures from the marsh	2.7, 2.8	$100,000	0
Prepare the upland portions of the easternmost island in the Case Road Pond to support seabird and shorebird nesting	2.8	$50,000	$2,000
Raise the elevation in portions of the marsh by spraying a layer of marsh mud on the cordgrass vegetation to improve habitat quality; implement in phases with monitoring and adaptive management components	1.2	$300,000	0
Install video cameras at the least tern nesting area and in the marsh to provide real-time viewing for the public	3.1,3.2	$14,000	$500
Design and implement a native plant area and interpretive program that focuses on past Native American land use practices on the Refuge	3.5	$35,000	$500
Construct a combination kiosk and rest-room facility with an interpretive focus on wise water use to the north of the Refuge headquarters	3.3	$200,000	$2,000
Construct an elevated observation platform within walking distance of the Refuge headquarters	3.2	$100,000	$1,000
Total		**$4,213,000**	**$160,500**

Table 6-3
Proposed Update to the RONS Database
Based on the Proposals Described in Alternative C (Proposed Action)

Proposed RONS Projects (presented in order of priority)	Corresponding CCP Objective	Operating Costs	
		First Year Cost	Recurring Annual Cost
Conduct hydrological modeling to assist in the design of a new water control structure near the center of the western Bolsa Cell levee	2.7	$45,000	0
Update previous subsidence study for Anaheim Bay	2.2	$50,000	0
Prepare restoration and monitoring plans for the 15 acres of disturbed land located southeast and west of 7th Street Pond	2.5, 2.6	$60,000	0
Prepare restoration and monitoring plans for the 22 acres of nonnative upland habitat at the north end of Case Road Pond	2.6	$65,000	0
Design and implement a program to monitor physical and biological changes (e.g., changes in tidal elevations, precipitation, distribution of tidal marsh plant communities, wildlife species diversity and abundance) on the Refuge that may be related to sea level rise and climate change	2.2	$30,000	$20,000
Design and implement a water quality monitoring program throughout the Refuge	2.7	$35,000	$25,000
Study freshwater flows originating from the Bolsa Chica and Wintersberg flood control channels to understand the effects on water quality in the marsh complex	2.7	$50,000	0
Evaluate the current conditions (e.g., site elevation, variability in tidal elevations, salinity, plant height and density) in areas of the Refuge that support cordgrass vegetation and design a study, with appropriate post-project monitoring protocols, to evaluate the effects on cordgrass health and vigor of raising the elevation in portions of the marsh plain	1.2, 2.2	$45,000	0
Install/ monitor the effectiveness of underwater structures to support marine organisms	2.7	$20,000	$500
Inventory fish and marine invertebrate populations in Anaheim Bay every three to five years in an effort to update existing baseline studies	2.1	$30,000	$6,000
Update, or where appropriate establish, baseline data for plant and wildlife species composition and relative abundance	2.1	$50,000	0
Implement directed searches for tiger beetles and, if appropriate, prepare and implement a management plan to protect sensitive species	2.1	$20,000	$500

Table 6-3 (continued) Proposed Update to the RONS Database Based on the Proposals Described in Alternative C (Proposed Action)			
Proposed RONS Projects (continued)	**Corresponding CCP Objective**	**Operating Costs**	
		First Year Cost	Recurring Annual Cost
Produce a Refuge resources interpretive video for public viewing at the Refuge Headquarters	3.1, 3.3	$25,000	0
Expand invasive plant species control to Navy lands abutting the Refuge, such as along roads and in adjacent agricultural fields	2.3	$50,000	$50,000
Total Estimated Cost		**$575,000**	**$102,000**

The estimated cost for implementing the SAMMS and RONS projects described in the proposed action (Tables 6-2 and 6-3) is $4,768,000 and the anticipated reoccurring annual cost for these new projects is estimated at $262,500.

Current and Future Staffing Needs

The Seal Beach NWR is part of the San Diego NWR Complex, which provides supervisory, administrative, and logistical support for the Refuge Manager at Seal Beach NWR. The percentages of time staff within the Complex that are dedicated to the operations at Seal Beach NWR are reflected in Table 6-4, as are the current and future (proposed) on-site staff needs for the Refuge. Based on the actions proposed in the CCP, the need for one additional on-site staff position (a full time wildlife biologist [GS 5/7/9]) was identified. If this position was to be filled, and funding was available for project implementation, the Refuge would be able to carry out all aspects of CCP to a reasonable standard. If the position is not filled, some aspects of the Plan may not be completed within the timeframe presented in Section 6.2. The estimated cost of providing the staffing needs for maintaining and operating the Seal Beach NWR is approximately $340,000.

Table 6-4 Estimated Staffing Needs to Fully Implement the Seal Beach NWR CCP		
Position (grade)	**Quantity**	**Unit[1]**
San Diego NWR Complex		
Project Leader (GS-14)	.20	FTE
Deputy Project Leader (GS-13)	.25	FTE
Administrative Office (GS-7)	.25	FTE
Refuge Planner (GS-12)	.25	FTE
Environmental Education Specialist (GS-11)	.25	FTE
Seal Beach NWR		
Refuge Manager (GS-11)	1.0	FTE
Maintenance Worker (WG-5)	1.0	PTE
Wildlife Biologist[2] (GS-5/7/9)	1.0	FTE

[1] FTE = Full Time Equivalency Position; PTE = Part Time Equivalency Position
[2] New position proposed in the CCP

Potential Funding Sources for Implementing CCP Projects

Many projects included in the CCP may be implemented in full or in part by sources other than the Refuge annual budget. These projects could be funded through partnerships with other local, state, or federal agencies, special legislative appropriations, or grants (e.g., National Fish and Wildlife Foundation, National Coastal Wetlands Grants Program, NOAA Restoration Center Grants). Other potential sources of funding for restoration projects include: the North American Wetlands Conservation Act Grants Program; and the Cooperative Endangered Species Conservation Fund.

6.8.2 Compatibility and Appropriate Use Determinations

As described in Chapter 1, the Improvement Act requires that all uses permitted on a NWR must be compatible with Refuge purposes and the mission of the NWRS and shall not be inconsistent with public safety. Before activities or uses are allowed on a Refuge, uses must be found to be both appropriate and compatible. A compatible use is defined as a proposed or existing wildlife-dependent recreational use or any other use of a Refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the Refuge System mission or the purposes for which a Refuge was established. A determination of whether or not a use is appropriate is required for all but wildlife-dependent recreational uses, which are identified in the Improvement Act as hunting, fishing, wildlife observation and photography, and environmental education and interpretation.

Compatibility determinations have been prepared for wildlife observation, interpretation, and environmental education. Both an appropriate use evaluation and compatibly determination have been prepared for mosquito management. These documents are provided for public review and comment in Appendix A.

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