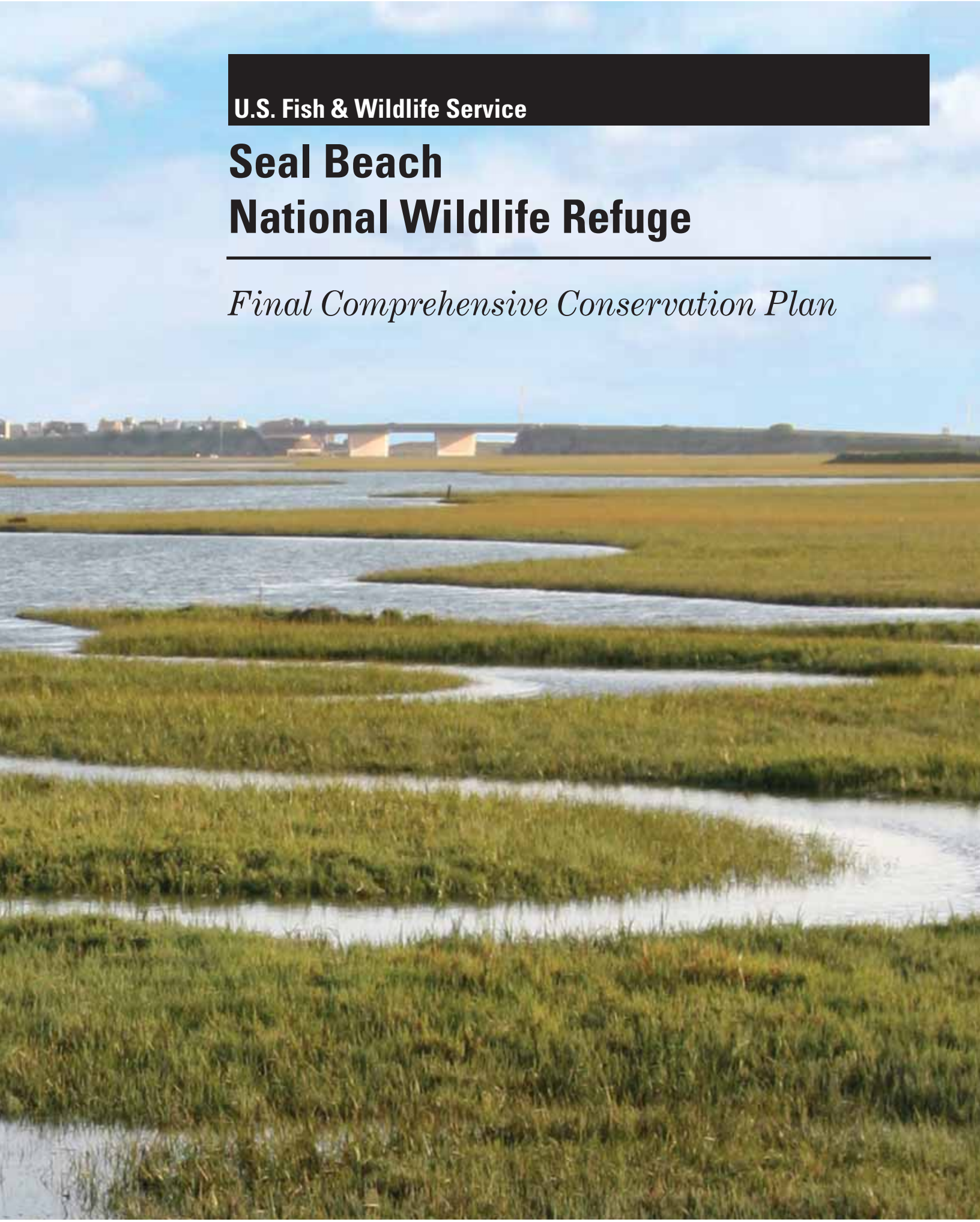
U.S. Fish & Wildlife Service

Seal Beach National Wildlife Refuge

Final Comprehensive Conservation Plan



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.

Seal Beach National Wildlife Refuge

Final Comprehensive Conservation Plan

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Implementation of this Comprehensive Conservation Plan and alternative management actions/programs have been assessed consistent with the requirements of the National Environmental Policy Act (42 USC 4321 et seq.)

U.S. Fish & Wildlife Service

Seal Beach National Wildlife Refuge

Final Comprehensive Conservation Plan
May 2012

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 sparrows and other upland birds find food and shelter within the native upland vegetation that borders the marsh.

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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 (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, Refuge System), is located entirely within the boundaries of Naval Weapons Station Seal Beach (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.

Migratory shorebirds at sunset on the Seal Beach NWR (Tim Anderson)

1.2 Purpose and Need for the Comprehensive Conservation 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 the Refuge was established and to contribute to the mission of the NWRS. The CCP 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 improvements.

The development of this CCP was 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 will develop a CCP for each refuge included within the NWRS.

Prior to the approval of the CCP, the plans available to direct management on the Seal Beach NWR were 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 was provided in these plans, there was no overarching management plan in place that described the future strategies to be implemented to address current and future changes in Refuge conditions, such as sea level rise, or for achieving Refuge purposes. This CCP provides the first comprehensive management plan for the Refuge.

This CCP sets forth Refuge goals and objectives, which are based on specific Refuge purposes, Federal laws, NWRS goals, and Service policies, and describes the strategies that will be implemented to achieve these goals and objectives. The CCP addresses all activities that will occur on the Refuge; however, the management activities or strategies may be broadly stated. In such cases, detailed step-down plans will be prepared 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. Step-down plans to be developed for the Seal Beach NWR are described in Chapter 5.

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.

Figure 1-1. Vicinity Map - Seal Beach National Wildlife Refuge

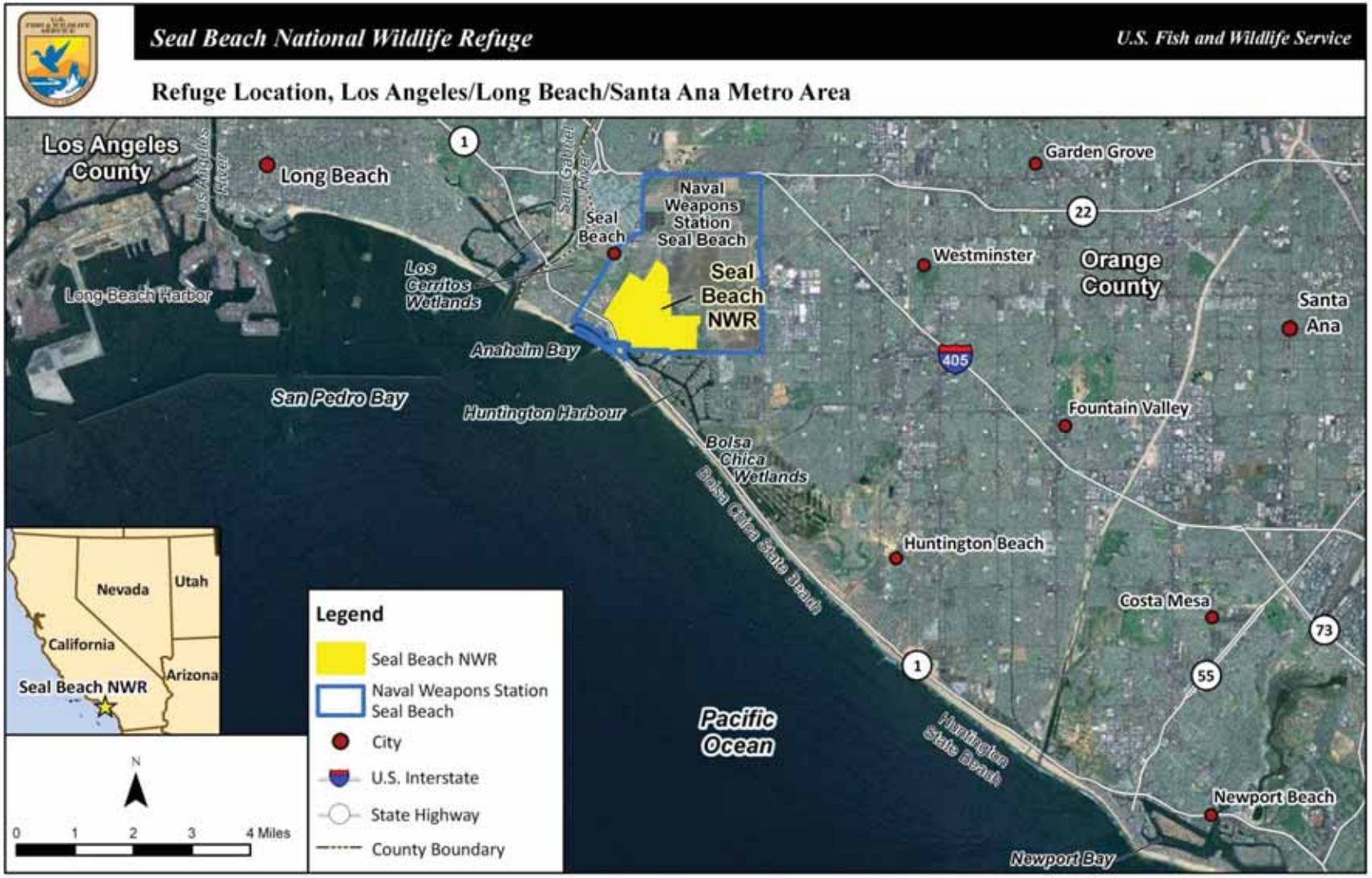

Figure 1-2. Location Map - Seal Beach National Wildlife Refuge

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 more than 550 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 (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 the environmental assessment (EA) that was prepared in association with the CCP are described in this section.

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 here.

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 (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. The Refuge has completed draft compatibility determinations for wildlife observation, interpretation, and environmental education, as well as mosquito control and research. These compatibility determinations, which are provided in Appendix E, were provided for public review and comment as part of the public review process for the draft CCP/EA.

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 (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 following four conditions. 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, which 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 E.

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 eliminate one of the uses 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 (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 the 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 the 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 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 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 5, Implementation, and presented in greater detail in Appendix J.

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 was 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 is integrated into the CCP process at the earliest possible time, an EA was integrated directly into the draft CCP document for the Seal Beach NWR. This draft document was distributed for public review and comment in spring 2011. The final planning document consists of the Final CCP, with the EA and associated Finding of No Significant Impact included as Appendix F of this document.

1.5 Seal Beach National Wildlife Refuge

1.5.1 Location

The 965-acre Seal Beach NWR, which is included entirely within Naval Weapons Station Seal Beach, 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 Naval Weapons Station Seal Beach, 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.

Seal Beach NWR protects a portion of the historical Anaheim Bay salt marsh complex (Tim Anderson)

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, western snowy plover (*Charadrius alexandrinus nivosus*), and Belding's savannah sparrow (*Passerculus sandwichensis beldingi*). The federally listed endangered eastern Pacific green sea 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 longstanding 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 Chapter 4 for additional details).

Additional ecosystem planning efforts that address the resources managed within the Seal Beach NWR are described here. 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 U.S. 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 California Coast and Mountains Region of the Sonoran Joint Venture Bird Conservation Plan. Orange County coastal wetlands, which include Anaheim Bay, are identified in this bird conservation 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 for the coastal wetland areas of the California Coast and Mountains Region are protection of the remaining coastal wetlands, including eelgrass beds; protection of existing avian nesting colonies, development of education programs; and 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 watershed management objectives; recommends strategies for achieving the objectives; and addresses issues related to water supply, water quality, flood control, ecosystem restoration, and climate change. Plan implementation requires funding for projects that benefit water and habitat quality throughout the watershed.

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."

Partnering to protect sensitive coastal habitat and species (K. Gilligan/USFWS)

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 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).

California least tern at the Seal Beach NWR (K. Gilligan/USFWS)

Additional details regarding the Refuge's establishment 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." The Refuge purposes are further refined 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 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 Naval Weapons Station Seal Beach 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 Naval Weapons Station Seal Beach, 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 Naval Weapons Station Seal Beach. 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 Naval Weapons Station Seal Beach 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 Naval Weapons Station Seal Beach.

Figure 1-3. Artist's Rendition of Proposed Freeway Bisecting Anaheim Marsh in the Early 1960s

2 The Planning Process

2.1 Preparing a Comprehensive Conservation Plan

The purpose of the CCP for the Seal Beach NWR is to guide the management of the Refuge for 15 years following plan approval. The CCP was prepared in conjunction with an EA to meet the dual compliance requirements of the Improvement Act and the National Environmental Policy Act (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. 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.

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. This Final CCP marks the completion of the major milestone in the CCP process. Following completion of the public review process, Alternative C was selected as the preferred management alternative. The next steps in the CCP process are implementation, monitoring, review of monitoring results, and possible revisions to the CCP in the future as needed to meet Refuge purposes, goals, and objectives. The various management actions to be implemented over the next 15 years per available funding are presented in Chapter 3.

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 Naval Weapons Station Seal Beach. Appendix A 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 was not available to participate at this level due to time constraints. 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.

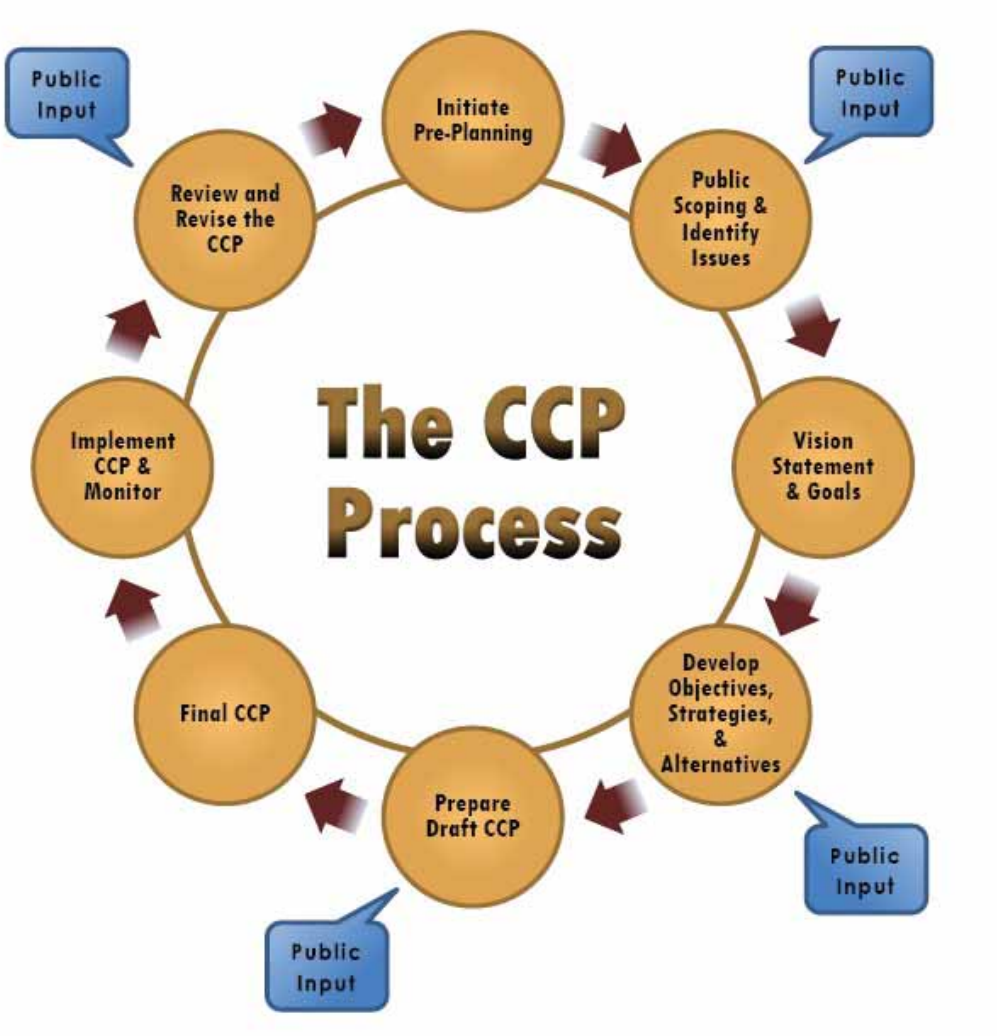

Figure 2-1. Comprehensive Conservation Planning Process

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.

On March 24, 2011, the Notice of Availability of the draft CCP/EA for the Seal Beach NWR was published in the *Federal Register*. Public comments were accepted through May 11, 2011, and a public meeting was held on April 6, 2011. Notice of the document's availability was distributed to Federal, State, and local agencies, Tribal governments, State Clearinghouse, Seal Beach Public Library, and interested organizations and individuals.

Five comment letters were received during the public review process, and Refuge staff met with the Orange County Vector Control District (OCVCD) to discuss issues related to the draft Mosquito Management Plan. The Final CCP and EA were modified, as appropriate, to address concerns raised in the comment letters and by OCVCD. One change involved the draft Mosquito Management Plan, which was included in the draft CCP/EA. In an effort to ensure consistency between mosquito management on the Seal Beach and elsewhere with the Refuge System, the Mosquito Management Plan was withdrawn from consideration. The plan will be reconsidered at such time as the Service approves a final Mosquito and Mosquito-Borne Disease Management Policy for the Refuge System. In the meantime, the Refuge Manager will continue to coordinate with OCVCD and the Navy on mosquito management issues and will prepare annual Special Use Permits (SUPs) for OCVCD that specify where, how, and to what extent mosquito management can be implemented on the Refuge.

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, by 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 here.

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 on Seal Beach NWR (USFWS)

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 Naval Weapons Station Seal Beach, 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 in this section, 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 affect 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 NWR, San Diego Bay NWR, and Seal Beach NWR), 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.

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 present 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).

Great blue heron (Tim Anderson)

In 1991, the Service and Naval Weapons Station Seal Beach 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.

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 Naval Weapons Station Seal Beach. More information about the various invasive species that could threaten the habitat quality on the refuge is provided in Chapter 4.

Contaminants

Waterbirds, like this snowy egret, are particularly susceptible to the effects of bioaccumulation (Tim Anderson)

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 it 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 Naval Weapons Station Seal Beach which provides challenges with respect to public access onto the Refuge. Because the mission for Naval Weapons Station Seal Beach 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 here, 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 for the Refuge and the strategies proposed for implementation as funding is identified are presented in Chapter 3.

2.8 Alternatives Development Process

The development and approval of a CCP must occur in compliance with NEPA. To facilitate this requirement, NEPA compliance was 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. The draft CCP/EA addressed a range of alternatives for the Seal Beach NWR CCP, including a No Action and two action alternatives. An equal and full assessment of the effects to the human environment of implementing each of these alternatives was conducted. The three alternatives described in the draft CCP/EA differed 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 Preferred Management Alternative

Following comprehensive review and analysis, the Service determined that Alternative C, as modified to eliminate the Mosquito Management Plan, was the alternative that would most effectively achieve the Refuge goals and objectives, particularly those goals and objectives related to the recovery and protection of federally listed species and the enhancement of public appreciation, understanding, and enjoyment of Refuge resources. The management proposals included in Alternative C will:

- Help achieve the mission of the National Wildlife Refuge System (Refuge System);
- Ensure that the Refuge will be administered in accordance with the Refuge System Administration Act of 1966, as amended, and pursuant to plans that are mutually acceptable to the Secretary of the Interior and the Secretary of the Navy, as per the legislation authorizing the establishment of Refuge;
- Facilitate achievement of Refuge purposes and the vision for the Refuge;
- Maintain and restore the ecological integrity of the Refuge's habitats and populations;
- Address the important issues identified during the scoping process;
- Address the legal mandates of the Service and the Refuge;
- Be consistent with the scientific principles of sound fish and wildlife management; and
- Facilitate priority public uses which are compatible with the Refuge's purposes and the mission of the Refuge System, as well as the mission of Naval Weapons Station Seal Beach.

A complete description of the selected management actions for the Seal Beach NWR is presented in Chapter 3.

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 5 describes how the approved CCP will be implemented, and Chapter 3 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, Chapter 5 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 Refuge Management

3.1 Overview of Refuge Goals, Objectives, and Strategies

The development of Refuge goals and objectives 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. 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 National Wildlife Refuge System (Refuge System, NWRS) mission and goals. *Goals*, which define general targets in support of the Refuge vision, are "…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). Full achievement of the Refuge goals may or may not be feasible within the 15-year time frame of the CCP, but the management actions and programs described in this chapter are intended to move us closure to realizing the Refuge vision.

The path toward achieving Refuge goals is defined by the objectives and strategies developed during the CCP Process. The objectives, which are derived from the goals and provide the basis for determining strategies and monitoring, are concise statements of what will be achieved to meet a particular goal. *Objectives* should be specific, measurable, achievable, results-oriented, and time-fixed, and should be feasible within the 15-year lifespan of the CCP. *Strategies* are specific actions, tools, or techniques that contribute toward accomplishing the objective. 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.

3.2 Refuge Goals

The following goals are intended to guide management actions on the Seal Beach NWR over the next 15 years:

Goal 1: Support recovery and protection efforts for the Federal 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.

3.3 Objectives and Strategies

The objectives that have been established for meeting the various Refuge goals, as well as the strategies to be implemented to achieve the objectives are presented here.

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 15 years.

California least tern (Tim Anderson)

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 (pers. comm. Marschalek November 2010). Between 2004 and 2010, the average numbers of nesting pairs per year observed at NASA Island was 183 pairs. 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) are 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 5-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
Strategy
Continue to partner with Naval Weapons Station Seal Beach 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 (USFWS and Navy 1991) to reduce predation of least tern chicks, eggs, and adults.
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 Naval Weapons Station Seal Beach 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 the Navy 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, 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.

Light-footed clapper rail (William Winters)

Objective 1.2 - Light-footed Clapper Rail
Strategy
Conduct predator management in accordance with the approved Endangered Species Management and Protection Plan (USFWS and Navy 1991) to reduce the loss of light-footed clapper rail adults, chicks, and eggs to avian and mammalian predators.
Restrict human access to rail nesting areas during the nesting season.
In partnership with Naval Weapons Station Seal Beach, 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 platform stability during strong wind and/or wave events, and enhancing structural durability.
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 Naval Weapons Station Seal Beach to remove or address potential avian predator perches adjacent to 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.
By 2014, coordinate with the Navy 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.

Salt marsh bird's-beak (L. Cox/USFWS)

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	
	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 of the Refuge 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 for sea turtles into 7th Street Pond and Perimeter Pond, future restoration and enhancement plans will be designed to address turtle ingress and egress requirements.

Objective 1.4 - Protect Access for Sea Turtles on the Refuge	
	Strategy
	In coordination with National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS), design future restoration and enhancement project s in a manner that will not impede sea turtle ingress and egress into open water areas of the Refuge.
	Incorporate appropriate measures into the scope of future restoration and enhancement projects to protect turtles during construction.
	Continue to support the efforts of NOAA NMFS to monitor the movement and activities of sea turtles within the Refuge.

***Objective 1.5*: Belding's Savannah Sparrow**
Continue current management strategies to annually support a minimum of 250 Belding's savannah sparrow territories on 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 affected 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	
	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, USFWS 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).

Perimeter Pond and the adjacent salt marsh habitat support a variety of special status species (USFWS)

Objective 1.6 – Protect Habitat to Benefit List and Other Species of Concern
Strategy
Continue to protect the salt marsh complex located 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.
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
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 deemed 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 affect 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
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 planting 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
Strategy
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 the Navy 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 non-native 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 2009). 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 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	
	Strategy
	Participate in the development and implementation of 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 transitional 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 (CDFG and USFWS 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 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 Coastal Wetlands
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 the Navy 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 (Artemisia californica), coast sunflower (Encelia californica), and coastal goldenbush (Isocoma menziesii).

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
Strategy
Continue to plant native upland vegetation in areas of the Refuge where non-native, 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.

Round ray foraging in a Refuge tidal channel (Tim Anderson)

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 coastal habitats, as well as the organisms these habitats support.

Objective 2.7 - Protect and Enhance Habitat for Fish and Marine Organisms	
	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 Naval Weapons Station Seal Beach 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.

Objective 2.7 - Protect and Enhance Habitat for Fish and Marine Organisms
Strategy
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 the Navy, establish a 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 2008) 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 species that travel along the Pacific Flyway.

The Refuge is an important stopover point for migratory shorebirds traveling along the Pacific Flyway (John Fitch)

Objective 2.8 - Migratory Birds
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 the Navy 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 nesting of terns, avocet, and black-necked stilts.

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 Naval Weapons Station Seal Beach, by 2015, conduct a minimum of four events each year focused on connecting families with nature. 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) (Louv 2005). If children are 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 (Louv 2005, Migliarese 2008). Fortunately, research also shows that connecting children and families with nature

Special events engage kids and benefit Refuge resources (John Fitch)

can provide positive benefits leading to improved physical and mental health (Faber and Kuo 2009, Pretty et al. 2009). 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	
	Strategy
	Continue to support the Friends group with their participation in off-Refuge events.
	In partnership with the Friends group and the Navy, 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, or 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 Naval Weapons Station Seal Beach.

Rationale: To comply with the mission of Naval Weapons Station Seal Beach, 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

Wildlife observation deck at Seal Beach NWR (USFWS)

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 Naval Weapons Station Seal Beach.

Objective 3.2 - Wildlife Observation
Strategy
Continue to provide opportunities for wildlife observation by maintaining the 0.6-mile interpretive trail that extends from the native plant garden to Bolsa Avenue.
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 online, of the activities occurring in these areas.

***Objective 3.3*: Environmental Interpretation**

When funding is available, design and implement, in partnership with Naval Weapons Stations Seal Beach, 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.

Interpretive signs communicate specific messages to Refuge visitors (USFWS)

Objective 3.3 - Environmental Interpretation
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 group with the support they need to implement these important activities.

Refuge staff and volunteers participate in the Children's Water Education Festival at U.C. Irvine (USFWS)

Objective 3.4 - Environmental Education
Strategy
Continue to provide support to the Friends group 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 traveling library display program to showcase Refuge resources.

***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	
	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 (MOU) 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 Refuge System and the goals of the Seal Beach NWR, as well as the mission of Naval Weapons Station Seal Beach, 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 and pursuant to plans that 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 Naval Weapons Station Seal Beach Integrated Natural Resources Management Plan (INRMP). It is through close communication and coordination that the management proposals established by each agency can be effectively implemented.

Objective 4.1 - Effective Interaction to Preserve Respective Missions	
	Strategy
	Continue to inform appropriate offices at Naval Weapons Station Seal Beach of potential projects and activities on the Refuge that may affect station operations, and coordinate with the Navy on implementation actions.
	Finalize an MOU between the Service and the Navy on management actions affecting the Refuge and the Naval Weapons Station.
	Continue to work with Navy to resolve conflicts between the activities on the small arms range and endangered species management on the Refuge.

3.4 History of Past Refuge Management

3.4.1 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.

3.4.2 Prior Management Documents that Continue to Guide Refuge Management

The first management document prepared for the 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" (General Plan). The General Plan was jointly signed by the Secretary of the Interior and the Secretary of the Navy in 1973. The purpose of the General Plan was to identify the lands and waters within Naval Weapons Station Seal Beach 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 General 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 that are mutually acceptable to the Secretary of the Interior and the Secretary of the Navy. The General 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 General 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 of Naval Weapons Station Seal Beach. 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 (CDFG) 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 Naval Weapons Station Seal Beach, 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.

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

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: 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.

3.4.3 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.

In 2011, staff for the Refuge included 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 Naval Weapons Station Seal Beach personnel in the Environmental Programs and Services Department, Public Affairs Office, Facilities Department, and other departments responsible for operations at Naval Weapons Station Seal Beach.

3.4.4 Prior Refuge Actions

The first significant habitat modification project on the Refuge occurred in 1973 when construction of a four-acre least tern nesting site began at the southeast end of the Refuge, in the area that today supports Perimeter Pond. This site was intended to serve as mitigation for the removal of a least tern nesting area located in the vicinity of Huntington Harbour. Preparation of the site included placing sandy material from the existing nesting site in Huntington Harbour on the proposed nesting site and installing fencing around the site perimeter. Although the site was available for the 1974/1975 nesting season, least tern nesting was never documented at the site.

In 1976, efforts began to create a least tern nesting site on NASA Island. 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 (refer to Figure 3-1). From 1963 to 1974, a 40-acre section of Naval Weapons Station Seal Beach, 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 Naval Weapons Station Seal Beach and NASA Island was created for use as a rocket testing site. It was used for this purpose until the site was 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; 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 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 CDFG 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 reestablish 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.

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 will continue under the approved CCP.

The largest restoration project implemented on the Refuge was the Port of Long Beach Mitigation Project. This $7 million project, which reclaimed about 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.

In 1986, the Service and Navy prepared an environmental assessment to address the impacts of implementing predator management on Naval Weapons Station Seal Beach to protect listed species. A major emphasis of the proposal was the control of the non-native red fox population on the site, which posed 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 (ROD) in 1991, the Endangered Species Management and Protection Plan was approved and control of red foxes was initiated.

In 1996, the nesting substrate on NASA Island was enhanced when 3,000 cubic yards of sand from Shellmaker Island in Newport Beach was spread over a portion of the nesting site. 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 crushed oyster shell was spread over a portion of the nesting site.

A California least tern scattered oyster shell around this nest on NASA Island (USFWS)

3.5 Ongoing and Future Refuge Management Actions and Programs

Another important step in the CCP planning process was the development and analysis of various management alternatives for the Refuge. 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 National Environmental Policy Act (NEPA) process, as described in the EA provided as Appendix F.

After considering the results of the analysis conducted during the development of the draft CCP/EA, as well as the input provided during the public review process, a final management plan was selected from among the three alternatives described in the draft CCP/EA. The details of the selected plan are illustrated in Figure 3-2 and described here.

3.5.1 Wildlife and Habitat Management

The 1974 Management Plan for the Seal Beach NWR, the 1991 Endangered Species Management and Protection Plan, applicable Service endangered and threatened species recovery plans, and various bird conservation plans have provided the basis for the wildlife and habitat management activities implemented on the Refuge up until 2011. The majority of these activities have been 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. Refuge management under the approved CCP will continue to rely on the guidance and directives included in these documents, as well as the additional guidance provided by the Refuge goals, objectives, and strategies presented here.

3.5.1.1 Endangered, Threatened, and Sensitive Species Management

California Least Tern. Annual pre-nesting site preparation will be conducted at NASA Island on an annual basis, per available funding. Site preparation involves weed control 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.

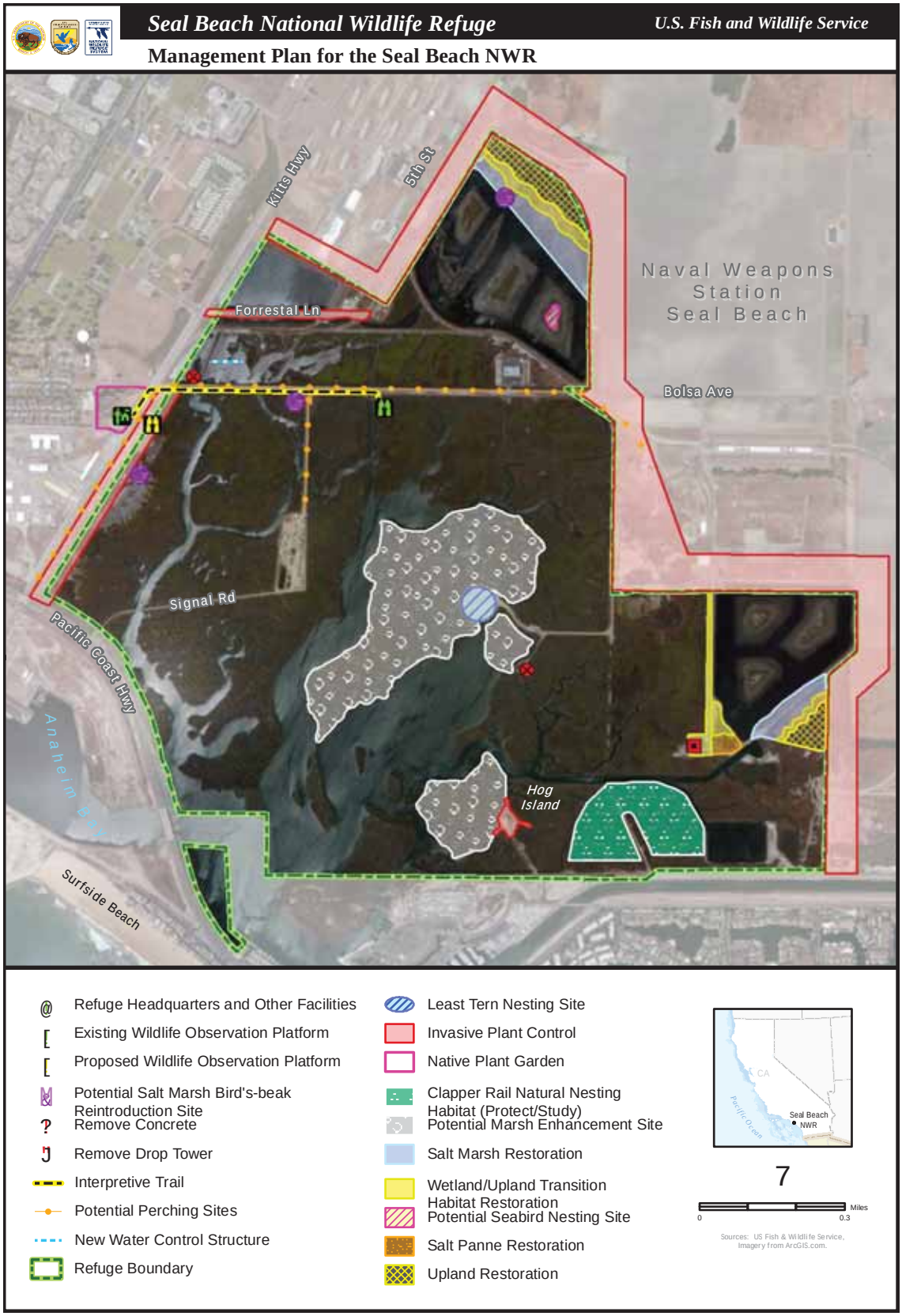

Figure 3-2. Management Plan for the Seal Beach National Wildlife Refuge

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 covered in clean sand. Vegetation growing on the site is normally killed in late winter through the 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 CDFG 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. The Refuge Manager will continue to work with the Navy in an effort to resolve conflicts between this predator control program and operations at the small arms shooting range.

The Refuge Manager will also work with the Navy to reduce perching opportunities around the marsh for avian predators. Potential actions could range from installing anti-perching material on existing power poles and rooftops to relocating existing poles well away from the marsh. Removing the drop tower would also eliminate a known perch site for avian predators.

Light-footed Clapper Rail. 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. 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. Coordination with the Navy will occur prior to the release of new birds into the marsh.

Releasing captive-bred light-footed clapper rails on Seal Beach NWR (USFWS)

Future step-down planning will include specific management proposals for the light-footed clapper rail. This plan, which will be prepared per available funding, will include details for implementing 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 throughout the marsh complex will be developed, and as specific strategies are implemented, monitoring will be conducted to determine their effectiveness in supporting rail nesting and improving rail productivity. As part of this step-down planning, study methods for 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 will be established. In addition, research projects will be encouraged to assist in: 1) identifying the factors that appear to favor natural nesting in this area; 2) comparing the fledgling success rates in these natural areas to fledgling success on nesting platforms; and 3) developing management options for improving habitat quality in other parts of the marsh in part to increase opportunities for natural nest sites on the Refuge.

One strategy to be explored as part of the step-down plan is pumping sediment of appropriate grain size and nutrient content over a portion of the marsh (refer to Figure 3-2) to raise the elevation of the marsh plain in response to subsidence and sea level rise. The design will consider the appropriate depth of sediment to be applied and the boundaries of the initial test site. It is anticipated that a thin layer of sediment would be applied 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. Part of this strategy will include pre- and post-project monitoring to identify any changes in clapper rail use of the area for foraging and nesting, as well as any changes in cordgrass vigor or coverage.

This step-down plan will also address the need for funding and partnerships to study the current health of the Refuge's cordgrass stands; 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.

The actions described here for reducing potential avian predator perching opportunities will also benefit the Refuge's light-footed clapper rail population.

Western snowy plover (Tim Anderson)

Western Snowy Plover. In 2011, the first western snowy plover nest was recorded on NASA Island. As a result, management of the NASA Island nesting site will take into consideration the potential for future use of the site by nesting plovers.

Eastern Pacific Green Sea Turtle. Management actions for the eastern Pacific green sea turtle will involve coordinating with NOAA NMFS staff to facilitate long-term turtle monitoring within the Refuge and to ensure that actions taken to implement the CCP will not adversely affect turtles. Measures to protect turtles during and after construction would be incorporated into the scope of future projects. These measures could include: conducting presence/absence surveys for turtles prior to and during 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 materials into subtidal habitat on which sea turtles could become entangled; and taking into account potential turtle movement when designing and sizing culverts and water control structures.

Belding's Savannah Sparrow. Management actions to support the State endangered Belding's savannah sparrow include minimizing disturbance in occupied Belding's habitat throughout the year and accommodating the statewide Belding's savannah sparrow survey that is generally conducted every five years. The restoration proposals described in this CCP will also provide additional habitat to support this species.

Salt Marsh Bird's-beak. The potential for establishing one or more populations of the federally listed endangered plant called salt marsh bird's-beak within future restored areas on the Refuge, 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 will be evaluated in coordination with Naval Weapons Station Seal Beach. If appropriate locations are identified, salt marsh bird's-beak seeds would be planted, and the site(s) would 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.

3.5.1.2 Predator Management

An important management activity implemented to protect endangered California least tern and light-footed 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 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 Naval Weapons Station Seal Beach that is supportive of endangered species and other native wildlife. 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 milestones have been accomplished, but actions continue to be implemented to ensure that this balance is maintained.

The principal means for providing endangered species protection on the Refuge via predator control involves habitat modification and population management. All methods used for controlling predators on the Refuge are implemented in conformance with government regulations and with Service and U.S. Department of Agriculture, Animal Damage Control guidelines and requirements.

Coyotes on the Seal Beach NWR help maintain a healthy predator balance (John Fitch)

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 euthanizing, 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, but 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—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 Naval Weapons Station. 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 Naval Weapons Station 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 Naval Weapons Station 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 per Service 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.

To further reduce the potential for avian predation of rails and least terns, the Refuge Manager will work with the Navy to identify and eliminate, to the extent practicable, perching opportunities for avian predators around the marsh.

3.5.1.3 Other Wildlife and Habitat Management Activities

General Management Actions. Management activities implemented to improve habitat quality include 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). The use of herbicides is addressed in greater detail in the Integrated Pest Management Plan section.

Controlling invasive plants improves native plant cover (K. Gilligan/ USFWS)

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.

Night mammal surveys are conducted on the Refuge and Naval Weapons Station in partnership with the Navy. 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.

Refuge Clean-up and Debris Removal. Refuge clean-ups involving volunteers and Refuge staff will continue to be organized on a periodic basis to remove trash and other debris from the edges of the marsh and adjacent uplands. Refuge staff will continue to work 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 Web site. 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 (BMPs) 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 Naval Weapons Station Seal Beach, 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.

Replacement of the Western Culverts in the Bolsa Cell. Two 30-inch culverts, installed within the western levee of the Bolsa Cell as part of the Port of Long Beach restoration project, are in serious need of replacement. 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. Funds will be sought to remove the deteriorating culverts, repair the levee, and install a new water control structure 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 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. The actual design of the control structure could, however, change following an initial evaluation of the current site conditions.

Installation of the new structure will require the incorporation of BPMs into the project design to avoid adverse effects to water quality and habitat during construction.

Following installation and testing of the new water control structure, the old culverts will be removed, and this portion of the levee will be filled and stabilized. Installation of the new structure, removal of the old culverts, and levee stabilization will most likely involve the use of a conventional land excavator. Debris and any excess fill from the project will be trucked away for disposal at an appropriate off-site location. All work will be conducted between September 15 and February 1 to avoid impacts to nesting birds. Once all construction and site clean-up has been accomplished, the top of the levee will be planted with appropriate native wetland/upland transitional and upland vegetation.

Invasive Plant Control beyond the Refuge Boundary. To reduce the spread of non-native weeds on Refuge lands, the Service will coordinate with Naval Weapons Station Seal Beach to identify funding for and implement an invasive plant control project for the upland areas located outside the Refuge along the perimeter of the Refuge boundary. The Refuge will also assist the Naval Weapons Station Seal Beach 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 will be taken to contain and eradicate it before it becomes established.

Management Actions to Support the Refuge's Sensitive Tiger Beetle Populations. 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. Funding and partnerships will be sought to implement a directed search for tiger beetles. Special emphasis will 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 (Comrack et al. 2008). In addition, funding and/or partnerships will be sought to facilitate the preparation and implementation of a tiger beetle management plan that would include measures for protecting, maintaining, and if necessary, enhancing habitat to protect current tiger beetle abundance and diversity on the Refuge.

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, funding will be sought 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.

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 will 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 will 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 will be conducted, per available funding, to compare current conditions to those documented in comprehensive surveys conducted in past years. Data from endangered species monitoring will 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 will assist the Refuge Manager in making necessary changes in ongoing management strategies to ensure that Refuge goals and purposes can continue to be achieved.

Monitor Tidal Channel Bathymetry and Channel Bank Stability. The slopes along major tidal channels and around the perimeter of the restoration ponds will be photographed to establish a baseline from which the effects of ongoing erosion in these areas can be assessed. These areas will 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.

Funds will also be sought to conduct an initial bathymetric survey of the main tidal channels in the marsh to establish baseline channel depths. This survey will be repeated, per available funding, every three to five years to determine what, if any, changes in channel bathymetry are occurring.

Bank erosion along the tidal channel that connects 7th Street Pond to Anaheim Bay (USFWS)

Implement a Five-Year Water Quality Monitoring Program. Funding and/or partnerships will 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 will 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.

Improve the Quality of Runoff Entering the Marsh. Refuge staff will 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 will 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.

Expand Opportunities for Research on the Refuge. The Refuge, in coordination with the Navy, will reach out to various graduate programs and other public agencies such as NOAA NMFS and the United States Geological Survey (USGS) to seek researchers interested in addressing research questions that benefit Refuge resources and improve management effectiveness.

3.5.1.4 Habitat Restoration

Opportunities for habitat restoration have been identified on approximately 37 acres of disturbed upland within the Refuge, including: 22 acres located to the north of Case Road Pond; approximately one acre on the easternmost 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 3-2. Table 3-1 provides a breakdown of proposed habitat acreages per location. As indicated in Table 3-1, these proposals emphasize the restoration of higher elevation coastal habitat in an effort to address future habitat changes on the Refuge as a result of 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. These habitat restoration proposals will ensure some areas of upland and upland/wetland transition at the edges of the marsh in the future.

Table 3-1 Habitat Restoration Proposals for Seal Beach NWR		
Area	**Area (acres)**	**Habitat to be Restored**
Northern portion of Case Road Pond site	8	Upland (coastal sage scrub)
Middle portion of Case Road Pond site	4	Wetland/upland transition
Southern portion of Case Road Pond site	10	Intertidal salt marsh and mudflat
Easternmost 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)

Restoration on the Refuge could be implemented as one comprehensive project, or the restoration could be phased over a number of years. The extent and timing of when various restoration proposals are implemented will 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.

Development of all restoration designs and engineering plans will be coordinated with various departments at Naval Weapons Station Seal Beach to address such issues as the Installation Restoration and Munitions Response Programs, public utilities and easements, and traffic control during construction. Once the final restoration plans are completed for these areas, the project(s) will be reviewed for consistency with the analysis provided in the EA that was prepared for the CCP. 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.

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 is expected to involve the removal of fill material to achieve elevations supportive of type of habitat proposed for each site.

The Case Road Pond site and the area to the southeast of 7th Street Pond will 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) are envisioned to 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 will be restored to wetland/upland transitional habitat.

The area located to the east of the drop tower, which is proposed for future removal, will be restored to salt pan habitat, and the four inactive monitoring wells in the vicinity of 7th Street and the bunkers to the west of 7th Street Pond will be removed prior to restoration. Before restoration could occur in this area, issues related to Munitions Response Program Site AOC2 would have to be resolved, and the small bunkers located to the west of 7th Street Pond would have to be removed. Removal of the monitoring wells will 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 will require compliance with applicable County of Orange regulations.

Conventional land excavators, motor graders, and dump trucks will likely be used to achieve the desired elevations and excess material will be removed to an appropriate offsite location. Little, if any, earthwork will be required to prepare the 11 acres of disturbed upland for coastal sage scrub restoration. The specific details regarding volumes of cut and fill and overall site design and grading will 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 will be installed to supplement natural species recruitment. Areas proposed for wetland/upland transitional and coastal sage scrub will require the greatest density of installed plant material. Wetland/upland transitional habitat and coastal sage scrub habitat will be planted in the fall when temperatures are cooler and the likelihood for precipitation is higher. The native wetland/upland transitional vegetation will consist of species such as 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*). The primary components of the coastal sage scrub habitat would include flat-top or California buckwheat (*Eriogonum fasciculatum*), California sagebrush (*Artemisia californica*), lemonade berry (*Rhus integrifolia*), coyote brush (*Baccharis pilularis*), coast sunflower (*Encelia californica*), white sage (*Salvia apiana*), and coastal goldenbush (*Isocoma menziesii*). Soil amendments and moisture gel packs will 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 will be provided to ensure successful plant establishment.

Another habitat restoration project involves the four highest mounds on the easternmost island in Case Road Pond, areas that currently support non-native, weedy plants. This proposal includes the removal of all vegetation from these areas followed by the placement of clean sand over the prepared areas to establish sites suitable for nesting by ground nesting seabirds such as Forster's terns (*Sterna forsteri*) and black skimmers (*Rhynchops niger*).

In addition to the restoration sites described here, 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 non-native plants, would expand habitat for native wildlife, and would minimize the potential for erosion. A typical species list for such plantings would include: flat-top or California buckwheat, California sagebrush, lemonade berry, broom baccharis (*Baccharis sarothroides*), coyote brush, coast sunflower, white sage, and coastal goldenbush.

3.5.1.5 Integrated Pest Management Plan

In accordance with Service Policy (517 DM 1 and 569 FW 1), an Integrated Pest Management (IPM) approach would be utilized, where practicable, to eradicate, control, or contain pest and invasive species (herein collectively referred to as pests) on the Seal Beach NWR. The Refuge's IMP Plan is provided in Appendix G.

Current proposals for pest management, which focus primarily on invasive weedy plants, include mechanical and chemical control methods. Mechanical methods for removing 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. Following weed removal, efforts will be made to seed or plant these areas with native species to avoid reinfestation.

Integrated pest management will be implemented on the Refuge 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 will be used unless considerations of persistence or other environmental and/or biotic hazards would preclude it. In accordance with 517 DM 1, pesticide usage will be further restricted because only pesticides registered with the U.S. Environmental Protection Agency (EPA), in full compliance with the Federal Insecticide, Fungicide, and Rodenticide Act and as provided in regulations, orders, or permits issued by EPA, 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, it must be approved and registered by the State's Department of Pesticide Regulation.

Environmental harm by pest species refers 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 non-native plant species can out-compete 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 non-native 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.

All pesticides proposed for use on the Refuge must first 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 BMPs to avoid impacts to sensitive resources. In 2011, approval through the PUPS process was granted for the use of Aquamaster and Glyphosate Pro 4, with the active ingredient glyphosate; Habitat, with the active ingredient imazapyr; and Surflan AS, with the active ingredient oryzalin. Table 3-2 provides information regarding the specific uses and current application methods employed on the Refuge for each of these pesticide products.

Table 3-2
2011 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 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

Throughout the life of the CCP, with the exception of mosquito-related pesticides, all pesticides proposed for use on the Refuge will 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, will be documented in "Chemical Profiles." Chemical profiles completed for pesticides approved for use on the Refuge through the PUPS process in 2011 are provided in Attachment B of the IPM Plan (Appendix G).

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 will be approved for use on the Refuge. In all cases, BMPs will 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.

Pesticide use on the Refuge must also conform to the requirements of the Navy's approved IPM Program for Naval Weapons Station Seal Beach, 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 Online Pesticide Reporting System.

3.6 Public Use

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; however, with the Refuge located on a military weapons station, the types of activities permitted to occur on the Refuge are necessarily limited. Currently, the Refuge provides opportunities for wildlife observation, interpretation, and environmental education.

3.6.1 Public Access

Public access on the Refuge is restricted to guided tours and outings in accordance with military mission of Naval Weapons Station Seal Beach. The ability for the public to access the Refuge is subject to change, depending upon security conditions. Under normal security conditions, 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. Because there is generally greater demand to visit the Refuge than can be accommodated by the monthly tours, Refuge staff will work closely with Navy in an effort to identify additional opportunities for public access onto the Refuge for wildlife observation and environmental education purposes and to support requests for visits to the Refuge by educational institutions, non-governmental organizations, and archaeological/historical societies.

3.6.2 Wildlife Observation and Interpretation

A three-hour public walking tour of the Refuge is typically 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 Service staff and the Friends of the Seal Beach NWR, are conducted in cooperation with Naval Weapons Station Seal Beach. Visitors enjoy videos in the visitor contact station that describe the resources on the Refuge and provide an overview of the 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. To further enhance opportunities for wildlife observation, funding will be sought in partnership with the Navy to design and construct a two-level, 20-foot-high observation tower along the east side of Kitts Highway across from the Refuge Headquarters.

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 national annual events.

3.6.3 Environmental Education

Special tours of the Refuge are also held for school groups of all ages. In addition, a Refuge-sponsored off-site environmental education program, implemented by the Friends of Seal Beach NWR, serves about 500 students annually. In cooperation with Naval Weapons Station Seal Beach, consideration will be given to providing additional opportunities for environmental education and activities related to connecting people with nature on the Refuge.

3.6.4 Other Wildlife-Dependent Recreational Uses

Cameras are not permitted on Naval Weapons Station Seal Beach 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. There are however no opportunities for the public to participate in wildlife photography on this Refuge.

To avoid conflicts with the mission of Naval Weapons Station Seal Beach, hunting and fishing are also prohibited on the Refuge.

Murals painted on the Refuge headquarters building depict the wildlife protected at Seal Beach NWR (USFWS)

3.7 Refuge Operations

3.7.1 General Operations

On-site Refuge staff consists of a full-time Refuge Manager and a part-time maintenance worker. There is also a proposed for a full-time Wildlife Biologist, but this position is not yet funded.

Refuge staff works out of a building located outside the Refuge boundary on Navy land near the southwest corner of Kitts Highway and Bolsa Avenue. The Refuge headquarters consists of a small military building identified by the Navy as Building Number 226, as well as a few outbuildings and sheds used for storage and maintenance activities. The main Refuge office 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.

When funding is secured, a maintenance storage building and new public restroom will be constructed at the Refuge headquarters. Prior to construction, the plans for these facilities will be reviewed and approved by the Navy. Although these facilities will be located outside of the Refuge boundary, this proposal does not require an expansion of the Refuge boundary, just Navy approval to construct the facilities on Navy land. The facilities, once constructed, will be used to serve management and public use activities occurring on the adjacent Refuge. Details regarding these two facilities are provided here.

Maintenance Storage Building. As of 2011, most of the Refuge tools and equipment are stored in 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, construction of a new maintenance storage building is proposed on disturbed land to the south of the Refuge headquarters. The approximately 3,000-square-foot building is anticipated to include three vehicle bays to house a gator, small riding mower, and two passenger vehicles. The building will 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. As of 2011, the only restroom facility available to both Refuge staff and the public is a single-use restroom located in the Refuge headquarters building. 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, funding is being sought to construct additional permanent male and female restrooms to accommodate the current need. This restroom facility, which will be constructed using green technologies to reduce water use and energy, will most likely be located in a detached building constructed on the north side of the Refuge headquarters building.

3.7.2 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 group devotes thousands of hours each year to habitat restoration, endangered species monitoring, environmental education programs, public outreach, and much more. Without assistance from the Friends group, 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.

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 CDFG and the NMFS, that coordinate with the Refuge Manager on issues affecting coastal southern California resources.

3.7.3 Coordination with Naval Weapons Station Seal Beach

As a Refuge included within Naval Weapons Station Seal Beach, 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 Naval Weapons Station Seal Beach. Unlike the "wildlife first" mission of the NWRS, the Naval Weapons Station Seal Beach's mission 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 the Naval Weapons Station are directed toward achieving this mission, there are also various actions taken here 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 that are mutually acceptable to the Secretary of the Interior and the Secretary of the Navy. As such, coordination with Naval Weapons Station Seal Beach 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 offices at Naval Weapons Station Seal Beach. Coordination occurs most often with the Environmental Programs and Services Department, Public Affairs Office, Security Department, and Facilities Department. The Navy also provides funding for some of the management actions implemented on the Refuge.

To continue cooperative management within the Refuge, the Service coordinated with Navy staff in the development of this CCP. At the same time, the Navy has coordinated with Refuge staff on the completion of the Integrated Natural Resources Management Plan (INRMP) for Naval Weapons Station Seal Beach, which was prepared in accordance with the Sikes Act. 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 an INRMP for all of its military installations. INRMPs are 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. The ecosystem-based Naval Weapons Station Seal Beach INRMP was developed in cooperation with the Service and CDFG.

Other coordination actions with various offices at Naval Weapons Station Seal Beach involving security, pesticide use, restoration proposals, endangered species issues, cultural resource management, munitions, and contaminants will continue. The use of pesticides on the Refuge is reported through the Navy Online Pesticide Reporting System in accordance with the Installation's IPM Program; ecological risk assessments and clean-up actions that could affect Refuge resources are coordinated with the Refuge's and the Carlsbad Fish and Wildlife Office's

Contaminants Program; and the Refuge Manager serves as a member of the Restoration Advisory Board for Installation Restoration Program and Munitions Response Program site activities.

3.7.4 Mosquito Management

Although not implemented by Refuge staff, mosquito monitoring and control conducted on the Refuge by the Orange County Vector Control District (OCVCD) must be approved by the Refuge prior to implementation. OCVCD is also responsible for monitoring and controlling mosquitoes on the adjacent Navy lands. On the Refuge, mosquito management is conducted in accordance with a Special Use Permit (SUP) and approved PUPs, both of which are prepared on an annual basis. The SUP permits OCVCD to control populations of mosquitoes at selected locations on the Refuge for the purpose of protecting human and wildlife health and safety. Locations generally approved for mosquito monitoring and control are indicated in Figure 3-3. Past and current SUPs state that mosquito control shall rely on the use of physical and biological control as much as practicable prior to using chemical control.

The conditions included in annual SUPs for mosquito management must reflect the intent of the CCP, which is to implement mosquito management on the Refuge that is consistent with an IPM approach to mosquito control. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks. When practical, the approach may include compatible actions that reduce mosquito production and do not involve pesticides.

In some locations, mosquito production may be influenced by current site conditions. For example, historical human activities along the upper edges of a salt marsh complex may have altered the natural drainage patterns, creating areas where ponding now occurs during higher spring tides or after a significant rain event. In these situations, an integrated approach to mosquito management involving habitat manipulation and/or restoration and enhancement, which will be implemented by Refuge staff per available funding, could provide benefits related to reducing the area available on the Refuge for mosquito production. While the emphasis of mosquito management on the Refuge is on eliminating conditions that support mosquito breeding, mosquito management also includes mosquito monitoring, disease surveillance, and the potential application of pesticides.

The SUPs that are issued annually to the OCVCD for mosquito control represent a phased approach to mosquito control involving mosquito monitoring and control if monitoring indicates that control is warranted. The phasing proposals and conditions included in the SUP are intended to minimize adverse effects to Refuge resources while also addressing legitimate human and fish and wildlife health concerns and complying with Service regulations and policies.

This phased approach to mosquito management is dependent upon continued communication and cooperation among the Service, the Navy, OCVCD, and the appropriate State and local public health agencies. The following coordination actions will be implemented as part of ongoing mosquito management on the Refuge:

- OCVCD will coordinate all activities with the Refuge Manager.
- OCVCD will meet annually with Refuge and Navy Environmental Programs and Service Office staff to review the activities and results of the previous year and discuss the monitoring and possible control plans for the upcoming year.
- A Refuge SUP will be prepared annually for the OCVCD that will include appropriate, as well as special conditions related to location, timing, extent of mosquito monitoring, and stipulations for carrying out and reporting the use of pesticides, should it be warranted, under the guidance of the approved PUPs.

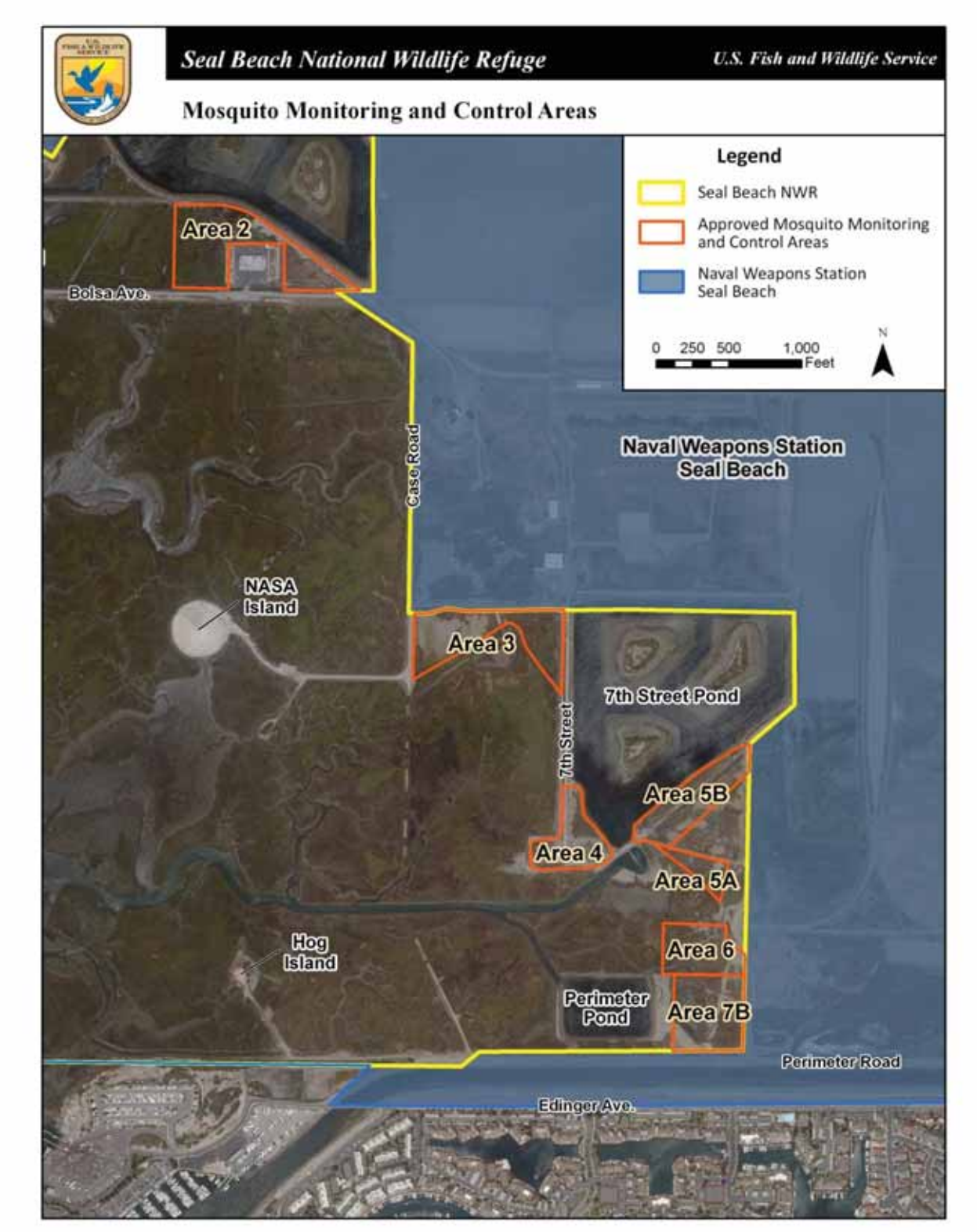

Figure 3-3. Approved Mosquito Monitoring and Control Areas on the Seal Beach National Wildlife Refuge

- Prior to each year's mosquito breeding season, OCVCD field staff will meet with Refuge management and the Navy Environmental Programs and Services Office staff to go over field protocols for avoidance and minimization of take to any trust resources, including migratory birds and listed species and their habitats.
- At the beginning of the mosquito breeding season, OCVCD will provide a firm schedule of seasonal activities to the Refuge Manager. If activities are proposed that differ from the schedule, OCVCD will call the Refuge Manager at least two business days prior accessing the Refuge.
- Motorized access into habitat areas will be prohibited; all access must be on foot.

Although OCVCD will have the lead for monitoring, disease surveillance, and pesticide applications, evaluation of monitoring data and approval for each management action will be the responsibility of the Refuge. This approach, which requires the Refuge Manager to oversee the mosquito management program, process PUPs, prepare annual SUPs, and comply with legal mandates (e.g., NEPA, Refuge Improvement Act) and Service policies (e.g., Compatibility, Appropriate Use), is necessary to ensure that the conditions for compatibility are met and the program is implemented so as to avoid or minimize effects on Refuge resources.

The activities to be conducted in each phase of mosquito management are described here.

Phase 1. In Phase 1, areas with the potential to support mosquito breeding will be monitored by OCVCD throughout breeding season. Consistent mosquito monitoring is necessary to establish baseline information regarding mosquito production and locations of mosquito breeding areas on the Refuge. On the Seal Beach NWR, monitoring is conducted annually by OCVCD to: 1) establish baseline data on species and abundance; 2) identify and map known mosquito breeding and/or harboring habitats; and 3) estimate relative changes in population sizes over time. The results of monitoring, including field observations, dip sample count data, and/or mosquitoes found in carbon dioxide traps are to be reported to the Refuge Manager on a weekly basis.

Mosquito monitoring is conducted in accordance with an annually issued Refuge SUP, which includes conditions related to how and where access for mosquito monitoring can occur, scheduling of monitoring activities, reporting monitoring results, and when the implementation of control methods (discussed under Phase 2) is considered appropriate. Mosquito monitoring is limited to pre-designated areas of the Refuge, and all access into these areas is limited to walking. Any proposal to enter and monitor other areas of the Refuge requires review and approval by the Refuge Manager. In addition, all OCVCD personnel who will be present on the Refuge in a given year are required to meet with the Refuge Manager prior to the beginning of the mosquito monitoring season. At this meeting, OCVCD is provided with information on how to conduct mosquito monitoring in sensitive marsh habitat in a manner that will avoid disturbance to listed species and other wildlife and minimize trampling of marsh vegetation.

The primary technique for determining the extent of the larval population within a specific area is the dip count. The dip count technique involves the use of a 16-ounce dipper that is dipped into a pool of water. The water is then examined for the presence of mosquito larvae. The numbers of larvae in each dip, as well as the species of the larvae present, are recorded. The dipping technique is difficult to standardize, but on the Refuge, dips are generally taken once a week during the breeding season. Dip samples, which are often timed to be taken after higher high tides, are obtained around the eastern edges of the salt marsh habitat from pools of water left behind by the higher high tides. Dip samples are also taken from the eastern end of the Bolsa Cell where monthly higher high tides leave behind stagnant pools of salt water. Dip samples are taken randomly throughout the site with up to 20 dip samples per site unless

the count for treatment (e.g., generally around one larvae per ten dip samples) is achieved in a smaller number of dip samples.

The OCVCD monitors the presence of adult mosquitoes on the Refuge by using carbon dioxide traps. These traps, which emit carbon dioxide, mimic a potential blood-meal to the mosquito. Carbon dioxide traps have been installed both on and adjacent to the Refuge. One trap is located just off the Refuge near the Refuge office building, and another is located off the Refuge just to the north of Case Road Pond. A third carbon dioxide trap has been installed on the Refuge at the drop tower, to the southwest of 7th Street Pond.

OCVCD is also responsible for implementing a surveillance program to detect the presence of mosquito populations countywide. The information gathered from this program would be used by the appropriate public health authority to determine if and to what extent a health threat exits in the County. The OCVCD countywide surveillance program involves placing more than 100 mosquito traps, including carbon dioxide traps and gravid traps, throughout the county. The mosquitoes collected in these traps provide information regarding species presence and general population estimates for a given area. Trapped mosquitoes are also tested for diseases (i.e., West Nile Virus, St. Louis and Western Equine Encephalitis). A statewide mosquito-borne encephalitis virus surveillance program is also conducted by the California Department of Health Services (DHS). DHS, OCVCD, and other agencies implement various programs to detect mosquito-borne viruses, particularly West Nile Virus. These include testing trapped mosquitoes, implementing a protocol for reporting and testing dead birds, and monitoring sentinel chickens. The only aspect of this program that occurs on the Refuge is the maintenance of a carbon dioxide trap near the existing drop tower. This trap can easily be accessed by an existing roadway and a short walk to the site. Additional traps are maintained just beyond the Refuge boundary on Naval Weapons Station Seal Beach.

Phase 2. In Phase 2, mosquito monitoring indicates that the number of larvae documented on the Refuge exceed the criteria used by OCVCD (2010) to determine when treatment to control mosquito larvae should be considered. Under these circumstances, the Refuge Manager can allow the control of mosquito larvae on the Refuge in accordance with the conditions included in the current year's SUP. The criteria used by OCVCD (2010) to determine when treatment to control mosquito larvae should be considered are presented in Table 3-3. At present, only the species *Aedes taeniorhynchus* and *A. sqaminger* are known to breed on the Refuge.

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

Mosquito Species	Criteria for Considering Treatment
Culex spp.	≥ 2 immatures/20 dips
Aedes spp.	≥ 2 immatures/10 dips
Culiseta spp.	≥ 2 immatures/10 dips

Source: (Orange County Vector Control District 2010)

Under Phase 2 conditions, mosquito monitoring, which would continue throughout the breeding season, is expanded to include an evaluation of the effectiveness of the mosquito control measures being implemented to control mosquito larvae populations on the Refuge.

All larvicides proposed for use on the Refuge must be approved through the PUPS review process, included in the current SUP, considered in the Compatibility Determination for Mosquito Management, and evaluated in compliance with NEPA, Section 7 of the ESA, and all applicable Refuge policies. The PUPS process is a formal pesticide use review process employed to ensure that all chemical pesticides approved for use on a Refuge 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. The PUPs identify specific pesticides, including mosquito control products, approved for use on each Refuge, as well as details on target pests, products applied, application dates, rates, methods, number of applications, site description, sensitive habitats, and BMPs 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. Depending on the product, PUPs are reviewed and approved at the Project Leader, Regional Office, or Washington Office level.

The larvicides approved for use on the Refuge as of 2011 include *Bacillus thuringiensis* 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 mimics a growth hormone found in mosquitoes and interferes with the mosquito's normal adult development. Methoprene is to be used on the Refuge only as a second line of defense, and the locations where it can be applied must be specifically approved by the Refuge Manager.

Within one week of any pesticide application, OCVCD is required to provide the Refuge Manager with a report detailing the location of the application, the numbers of larvae per dip sample obtained at each control site, the species present, and the types and amount of pesticide applied. All pesticides must be applied in accordance with the product label. In addition, the following BMPs, which are to be included as conditions of annual SUPs, must be implemented during larvicide applications:

Pesticide Handling and Mixing

- If OCVCD fills pesticide spray tanks on the Refuge, the tanks shall not be left unattended during filling.
- Cleaning of mosquito spray equipment will not be permitted on the Refuge.
- The Refuge Manager shall be notified immediately if a pesticide spill occurs on the Refuge during mosquito control, and the spill shall be addressed immediately using procedures identified in the Refuge's spill response plan.

Applying Pesticides

- Pesticide treatments shall only be conducted by applicators with the appropriate State certification to safely and effectively conduct these activities.
- Mosquito control shall comply with all Federal, State, and local pesticide use laws and regulations, as well as Departmental, Service, and NWRS pesticide-related policies.
- All applicators shall be familiar with requirements of the product label and Material Safety Data Sheet (MSDS).
- 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 less than 7 mph and preferably 3 to 5 mph) and consistent direction wind conditions with moderate temperatures (typically less than 85 degrees Fahrenheit).
- Equipment will be calibrated regularly to ensure that the proper rate of pesticide is applied to the target area or species.
- If windy conditions frequently occur during afternoons, spraying will typically be conducted during early morning hours.

Phase 3. Under Phase 3 conditions, control of mosquito larvae in the later instar stages and/or pupae will be considered when the numbers of such larvae or pupae present on the Refuge exceeds established mosquito threshold treatment levels (see Table 3-3). Prior to the application of pesticides to control mosquitoes in these stages of development, approval for the use of such pesticides must be obtained through the PUPS process; the SUP would need to be amended; and an evaluation of the potential effects to the environment of using the requested product(s) in accordance with NEPA would need to be conducted. To date, of the products evaluated for use on this Refuge through the NEPA process, only the use of monomolecular biodegradable film, such as Agnique MMF, for the control of mosquito larvae in the later instar stages and mosquito pupae has been included in the Finding of No Significant Impact for the Seal Beach NWR CCP/EA.

This CCP does not allow for the use of adulticides on the Refuge. In the event that mosquito surveillance in the vicinity of the Refuge indicates a potential for a public health emergency that could require control of adult mosquitoes on the Refuge, OCVCD should meet with the Refuge and Naval Weapons Station Seal Beach as soon as possible to discuss the procedures that would be required before any use of adulticides would be permitted on the Refuge.

3.8 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 Naval Weapons Station Seal Beach. In 1985, the Navy conducted an assessment of Naval Weapons Station Seal Beach, which included the Refuge, and identified eight Installation Restoration Program sites within the Refuge boundary (U.S. Navy 2007). 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. There are also two Munitions Response Program sites located within the Refuge, as described in Chapter 4, and an additional site located to the southwest of the small arms range that includes elevated levels of lead and potentially other constituents of concern. Any proposal to disturb these areas requires prior coordination and approval from Naval Weapons Station Seal Beach.

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 Naval Weapons Station Seal Beach, 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.

3.9 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 Naval Weapons Station Seal Beach. 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 State Historic Preservation Officer (SHPO), while other projects requiring greater ground disturbance would require SHPO review and concurrence.

The Refuge, in cooperation with Naval Weapons Station Seal Beach, will provide opportunities for archaeological and historical research. 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.

4 Refuge Resources

This chapter presents relevant information regarding the affected environment in and around the Seal Beach National Wildlife Refuge (NWR or Refuge). 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 Naval Weapons Station Seal Beach, while the boating and residential development associated with Sunset Harbour Marina and the community of Huntington Harbour border the Refuge to the south.

Anaheim Bay's tidal wetlands viewed during an autumn sunset at low tide (V. Touchstone/USFWS)

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. The Refuge office and a native plant garden are located on about four acres at the southwest corner of Kitts Highway and Bolsa Avenue, outside of the Refuge boundary.

Figure 4-1. Site Map - Seal Beach National Wildlife Refuge

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).

Western and least sandpipers rest and refuel at the Refuge (Tim Anderson)

4.1.3 Historical 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 1860s 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 1870s and the 1940s, 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).

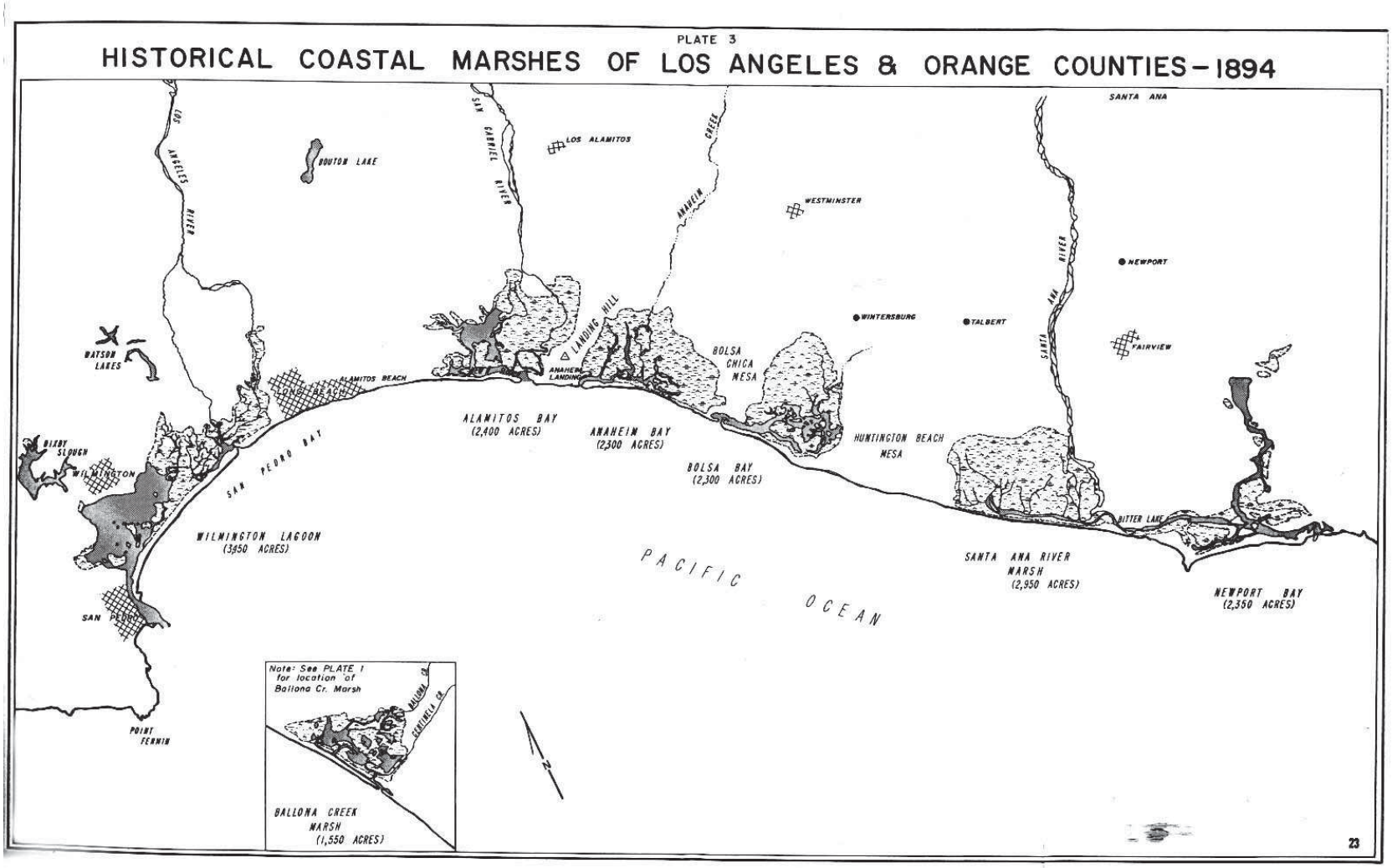

Figure 4-2. Historical (1894) Coastal Wetlands of Los Angeles and Orange Counties

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

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

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.

Oil Island, where oil has been extracted since the 1950s, is located in the center of Anaheim Bay, surrounded by the Refuge (USFWS)

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 Naval Weapons Station Seal Beach 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.

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 Naval Weapons Station Seal Beach 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.

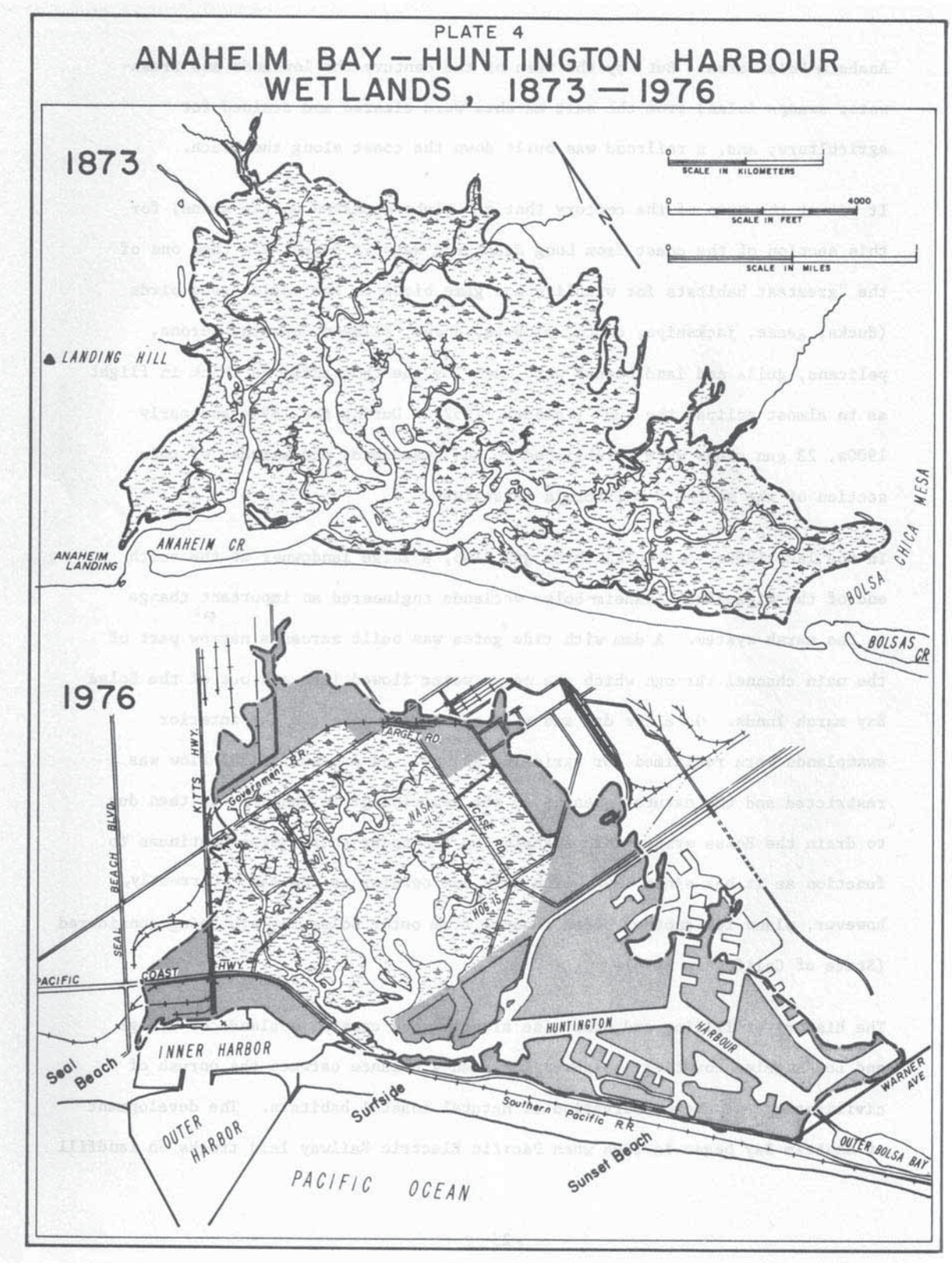

Figure 4-5. Comparison of Anaheim Bay in 1873 and 1976

Figure 4-6. Oblique Aerial View of Anaheim Bay, Seal Beach NWR, Northern Orange County, and Nearby Mountain Ranges

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, so 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), so 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 4.0 feet above MSL.

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 Naval Weapons Station Seal Beach 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.

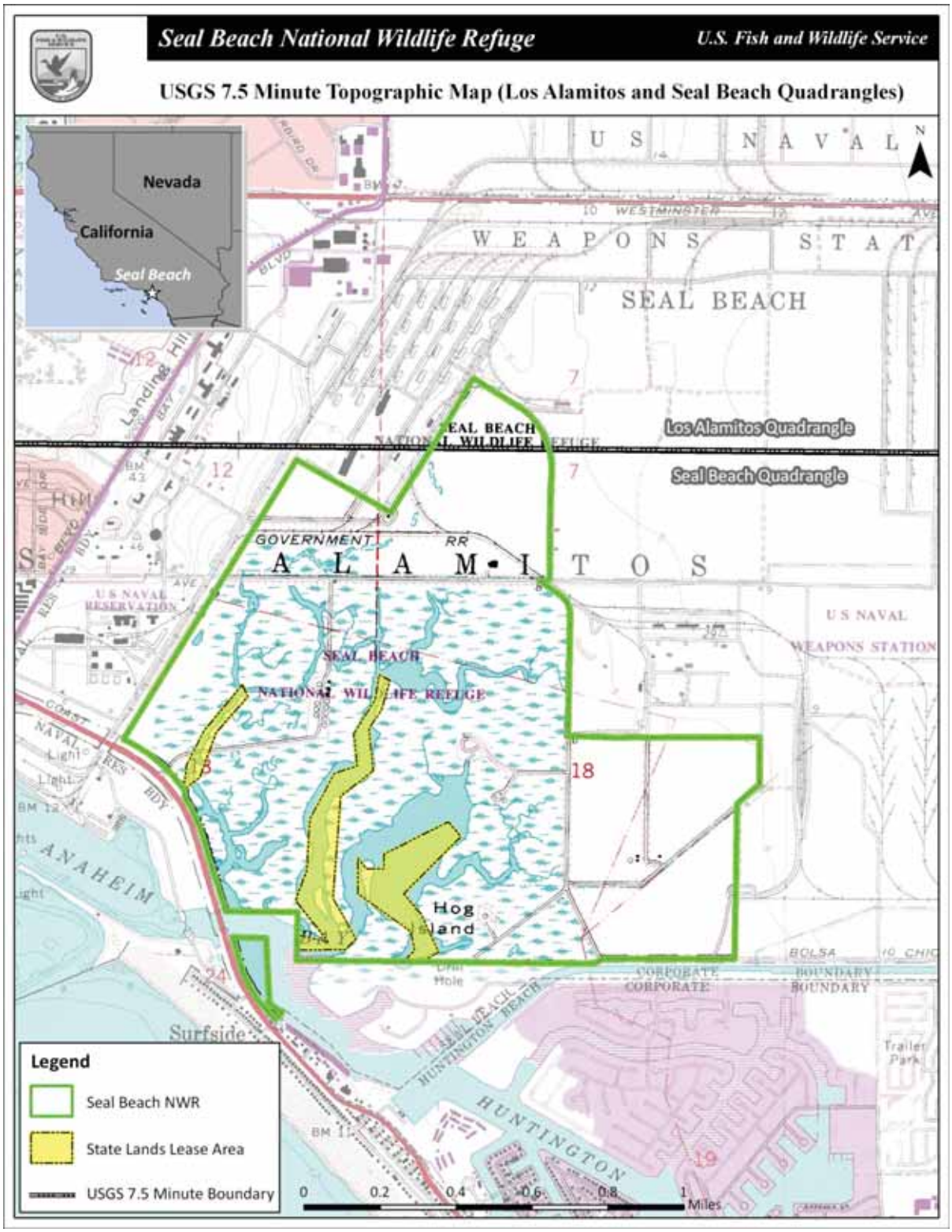

Figure 4-7. Topographic Map of Refuge from the U.S. Geological Survey

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.

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.

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

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 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.

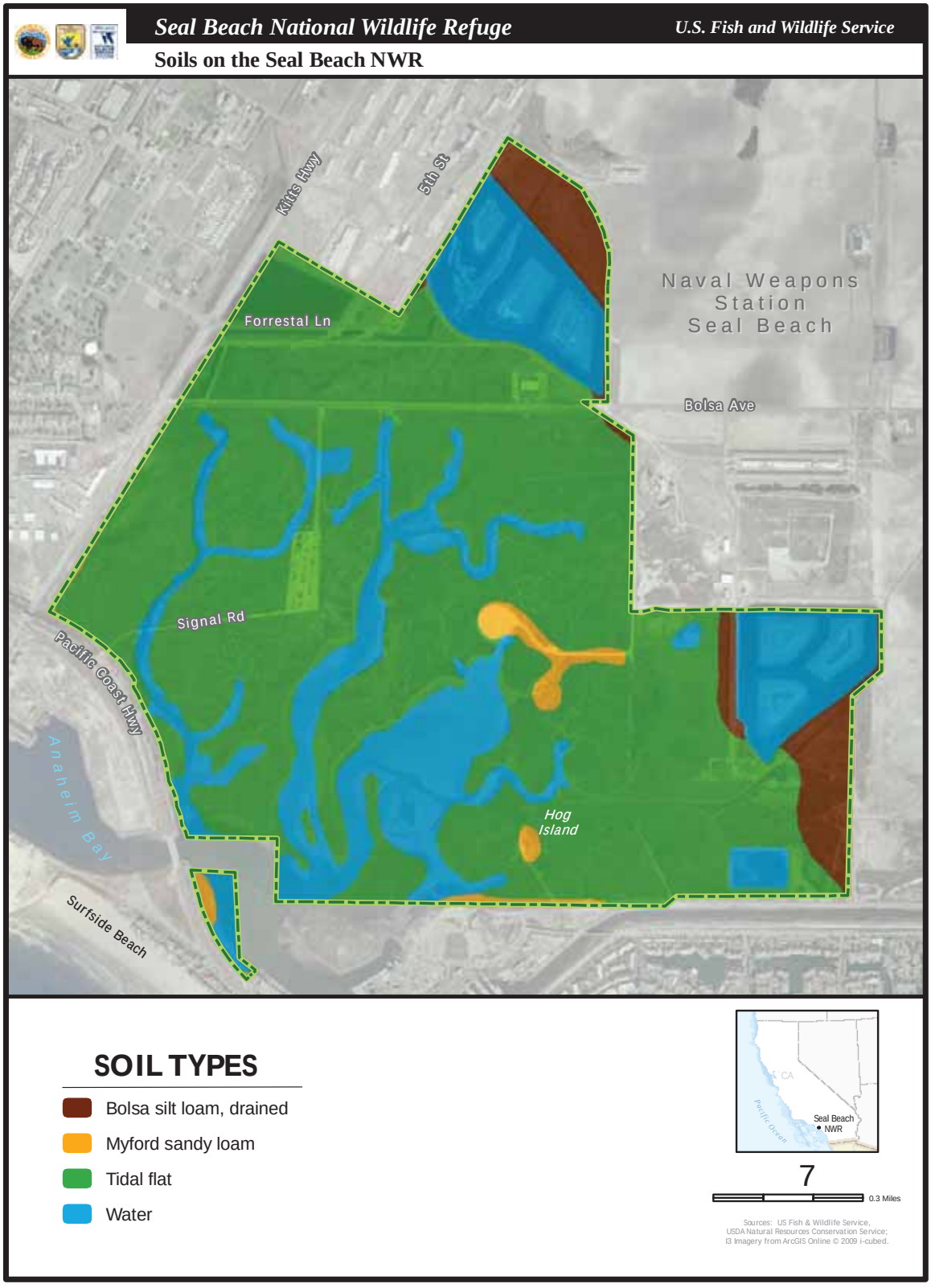

Figure 4-9. Soils Map

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 Naval Weapons Station Seal Beach, 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 Naval Weapons Station Seal Beach, 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 Naval Weapons Station Seal Beach, 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 1991). 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, 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.

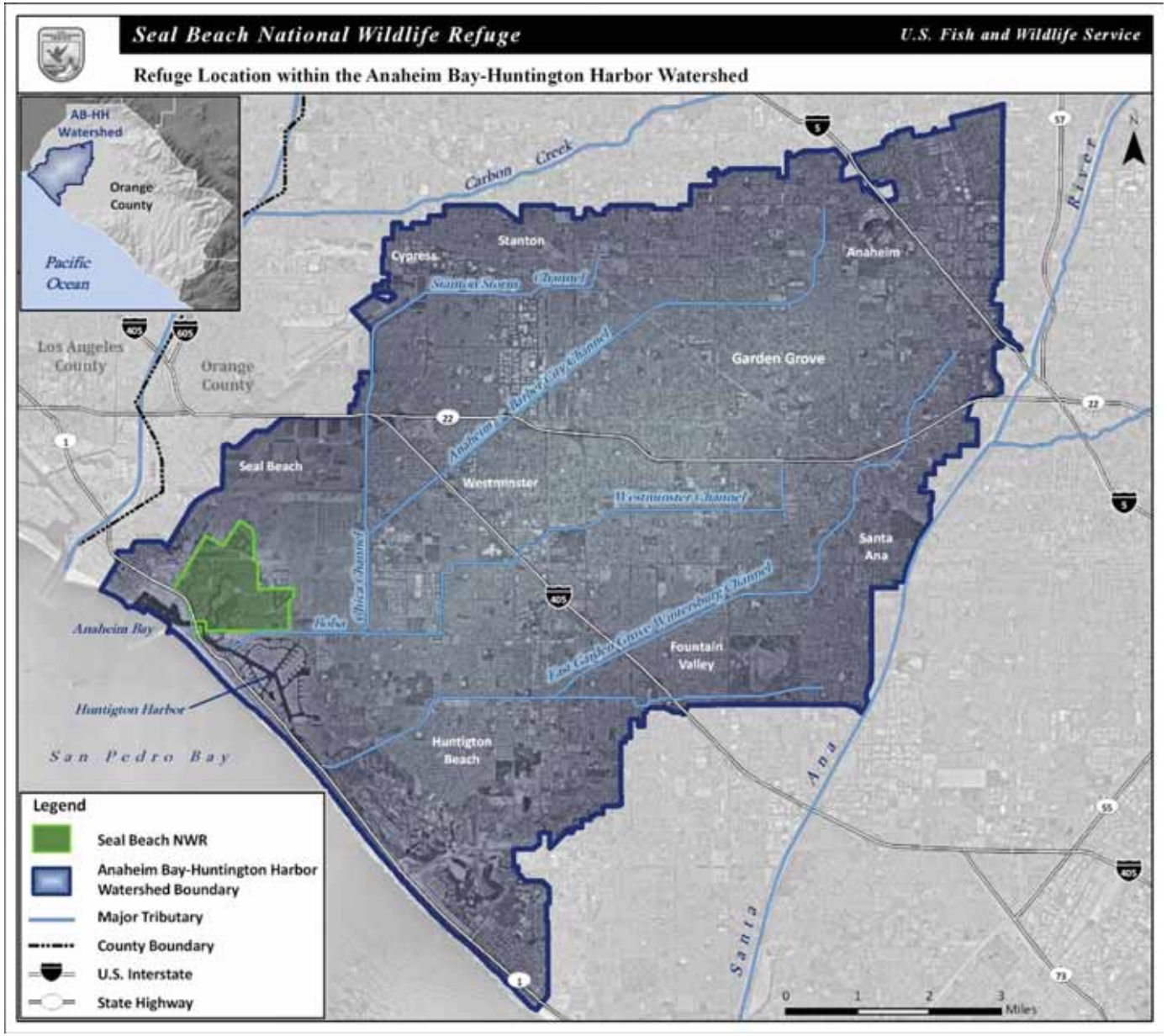

Figure 4-10. Anaheim Bay-Huntington Harbour Watershed

Figure 4-11. Tidal and Freshwater Conveyance Points

The portion of the Refuge located to the south of Bolsa Avenue and west of 7th Street generally experiences unobstructed regular tidal inundation, but some areas of historic marshland 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).

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 & 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 new 30-inch pipe culverts were placed in the new dike. 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 cleaned 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 described previously, 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 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 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 (CDFG 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 (CDFG 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 (CDFG 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, U.S. 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 (CDFG 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 (Orange County 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 (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 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 (RWQCB 1998).

The candidate toxic hot spots in Anaheim Bay include four sites within the Refuge and an additional site that is located within Naval Weapons Station Seal Beach. 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 (RWQCB 1995). The County of Orange's general storm water 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 (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 that 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/118,05,31W	Sediment toxicity	Chlordane, DDE
Seal Beach NWR	Navy Marsh	33,43,88N/118,04,72W	Sediment toxicity	DDE
Seal Beach NWR	Bolsa Avenue	33,44,65N/118,04,66W	Sediment toxicity	Arsenic
Seal Beach NWR	Middle Reach	33,44,44N/118,04,40W	Sediment toxicity	Arsenic
Seal Beach NWR	Left Reach	33,44,26N/118,05,18W	Sediment toxicity	Unknown
Huntington Harbour	Upper Reach	33,42,80N/118,03,67W	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 necessary to achieve and maintain specific water quality objectives (RWQCB 1995). The Basin Plan's (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 (WQAs) 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 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 elevated data levels. 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.

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 (percent)	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)

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 SWRCB has developed sediment quality objectives for toxic pollutants for 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 Naval Weapons Station Seal Beach, 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 storm water 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 2001-2002.

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 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.

A fall storm generates water spouts just to the south of the Refuge (K. Gilligan/USFWS)

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, 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 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 10 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˚ Celsius during the period, rather than the 0.14˚ increase expected because of increases in other greenhouse gases (Solomon et al. 2010).

Sea Level Rise. "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) (IPCC 2007a). 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 2007b).

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 centimeters (cm) (11.8 inches) to 100 cm (39.4 inches) by 2100 (IPCC 2007b). 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 H, 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 eight-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 eight-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 2007a). In March 2008, the USEPA adopted a new eight-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 eight-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 PM-2.5, and NOx supplemented with volatile organic compounds (VOC) to achieve Federal PM-2.5 standards. The AQMP's eight-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 mid-term control measures and achieving the eight-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 1991).

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 that no department, agency, or instrumental 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 non-attainment or maintenance area caused by a Federal action would equal or exceed established rates. In non-attainment 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 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 2007b). 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° Celsius (3.6° Fahrenheit).

To address GHG emissions at the Federal level, President Obama signed Executive Order 13514 on Federal Sustainability on October 5, 2009, 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, the Legislature passed and Governor Schwarzenegger signed California Assembly Bill 32 (AB 32), the Global Warming Solutions Act of 2006, which established a state goal of reducing GHG emissions to 1990 levels by the year 2020. 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 Naval Weapons Station Seal Beach, including the areas within the Refuge that were contaminated prior to establishment of the Refuge. In 1985, the Navy conducted an assessment of Naval Weapons Station Seal Beach, 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).

Also illustrated in Figure 4-12 are two Munitions Response Program (MRP) Sites (MRP Site UXO1 and MRP Site AOC2), which have been documented within the Refuge boundary. MRP Site UXO1 includes 39 acres in the northern portion of 7th Street Pond located within the Refuge boundary and 48 acres to the north of the pond, outside the Refuge boundary. Between 1944 and the 1990s, this site was used for ordnance storage. Based on an analysis of soil, sediment, and water samples taken from this site, constituents of concern are present that require remediation (ChaduxTt 2011). In addition, munitions and explosives of concern are present around the perimeter of the pond (ChaduxTt 2011). The site inspection report prepared for this site in 2011 recommends a time critical removal action for surface munitions and explosives of concern around the embankment of the 7th Street Pond, as well as the area to the north of the pond outside the Refuge boundary. MRP Site AOC2, the site of the drop tower, was found to contain munitions debris during a 2009 survey, and soil samples indicated the presence of several constituents of concern, including five metals (i.e., cadmium, copper, lead, selenium, zinc) that exceeded the corresponding ecological benchmarks and background screening criteria (ChaduxTt 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 Naval Weapons Station Seal Beach 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.

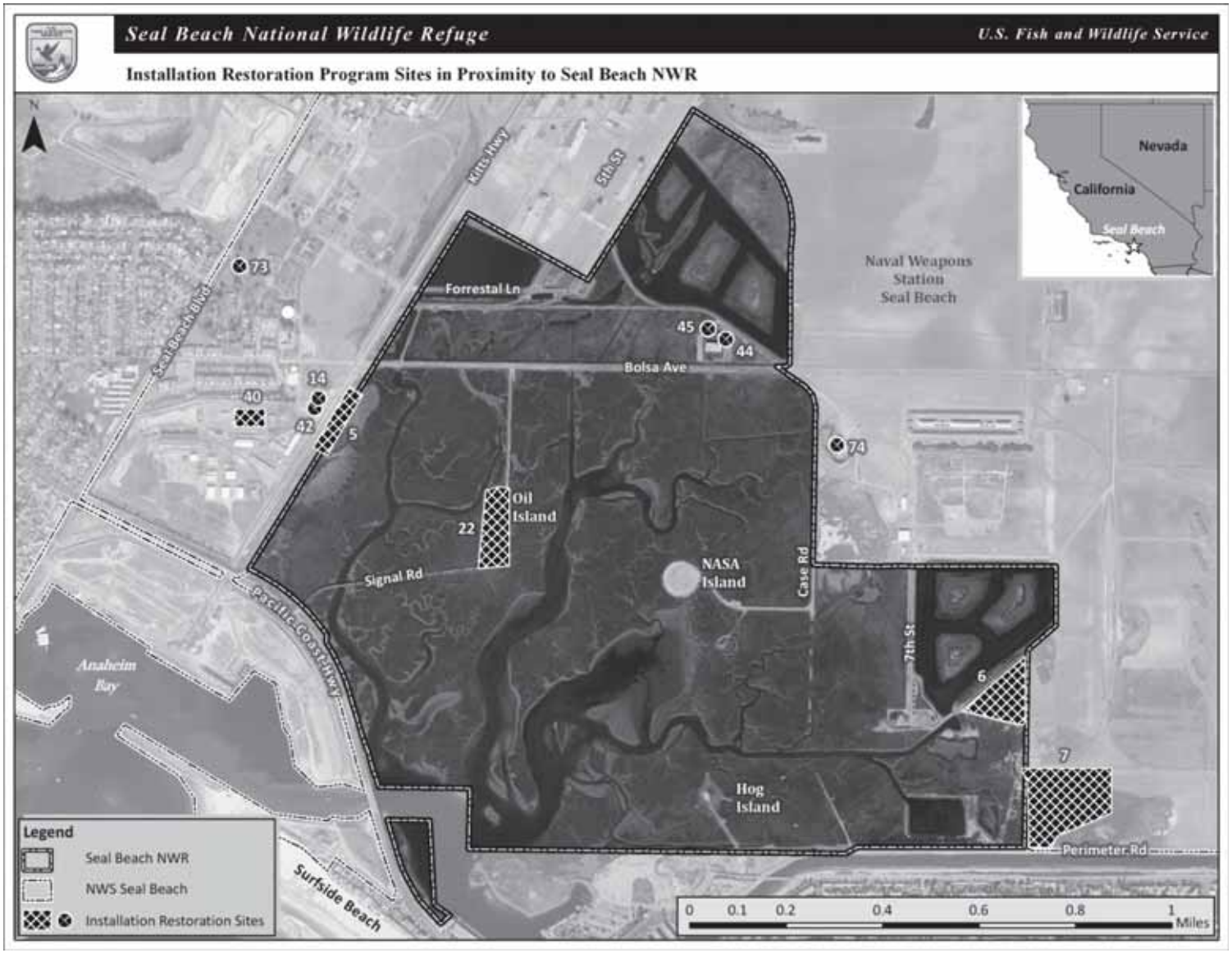

Figure 4-12. Installation Restoration Program Sites in Proximity to Seal Beach NWR

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 Refuge boundary and around eastern and northern perimeter of the Naval Weapons Station	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	Fill and debris removed in 2001, groundwater monitoring completed in 2006; clean-up 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; oil operator responsible for site management
40	Concrete pit/gravel area, located off the Refuge, west of the Refuge office	Engine work area and drainage, used 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 site, no other action planned
44	Former waste Otto fuel drum storage area, immediately to the east of the Bolsa Cell	Drum storage yard from mid-1940s – 1970s	Waste Otto fuel	Sediment removed; clean-up 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 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 Naval Weapons Station Seal Beach 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).

Other potential sources of contamination include the area southeast of the small arms shooting range, where lead has been detected in the marsh and the agricultural activity occurring on Navy lands located adjacent to the Refuge. The Naval Weapons Station Seal Beach Integrated Natural Resources Management Plan 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 2006a). 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. 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 Landscape Conservation Cooperative (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 CCP's 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, 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 (National Marine Protected Areas Center 2008). 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 (CDFG 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 hot spots 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 2010). 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.

Cordgrass-dominated salt marsh (USFWS)

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 C.

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**

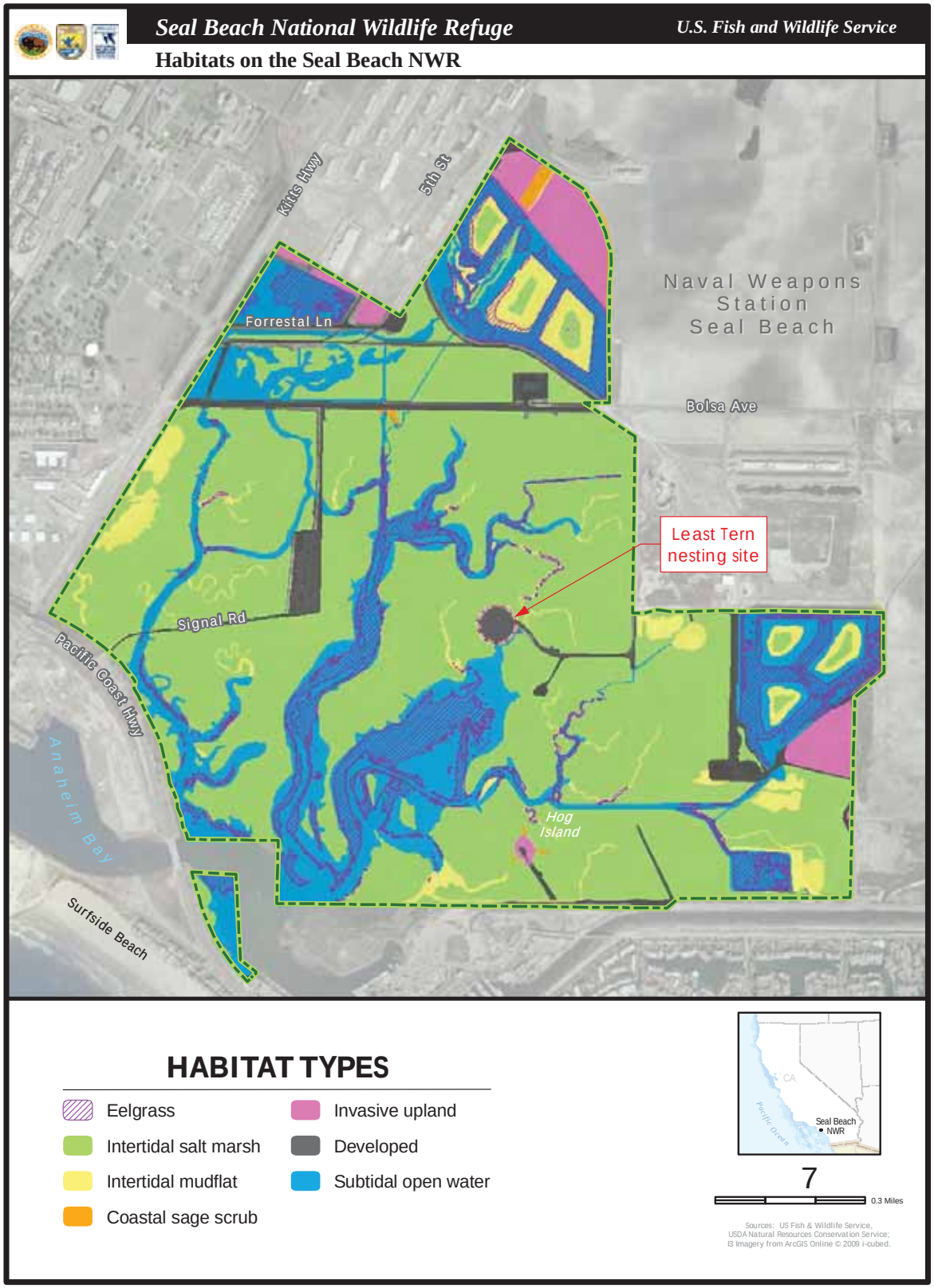

Figure 4-13. Habitats on the Seal Beach National Wildlife Refuge

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 southernmost 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 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.

Striped shore crab (Tim Anderson)

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 2011).

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* (CDFG 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.

Belding's savannah sparrow (Tim Anderson)

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 and U.S. Navy 1991) 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 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 Naval Weapons Station Seal Beach. 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 1985a*). 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 Naval Weapons Station Seal Beach 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).

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 Navy lands adjacent to the Refuge, 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 C.

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.

American widgeon, just one of the many species of waterfowl that winter at Seal Beach NWR (Tim Anderson)

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 Navy 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 Naval Weapons Station Seal Beach and may be seen roosting on a power pole or other structure within the Refuge.

Ferruginous hawks, uncommon seasonal visitors to the Refuge (Tim Anderson)

Another wintering bird of interest on the Refuge is the Nelson's 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.

Loggerhead shrike (Tim Anderson)

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 Naval Weapons Station Seal Beach and observations made during general Refuge management activities and monthly bird surveys. Nineteen species of mammals were listed as present or potentially present on Naval Weapons Station Seal Beach, 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 1991); 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 C.

California sea lion visits the Refuge (K. Gilligan/USFWS)

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 Naval Weapons Station Seal Beach in the past, but its presence has not been confirmed in recent years. A survey of reptiles and amphibians was conducted on Naval Weapons Station Seal Beach 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 Naval Weapons Station; 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 10 different days on the Refuge between July 2006 and October 2008, the primary researcher, Katherine Jirik, and other colleagues observed eastern Pacific green sea turtles in the 7th Street Pond, as well as in the connecting tidal channel. On 50 percent of these days, groups of two to four turtles 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 1991). The most abundant insects 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) (CDFG and USFWS 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.

Table 4-6
Reptiles and Amphibians Expected to Occur on Naval Weapons Station Seal Beach[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 Naval Weapons Station Seal Beach during the 2007 survey but not in proximity to the Refuge.

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 (Comrack et al. 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.

Tiger beetle foraging on the Refuge's open salt flats (Tim Anderson)

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 (Comrack et al. 2008). Restricted to the coastal zone, the larval form of this species is always found in association with salt grass. In all, Assis de Moraes (1977) identified approximately 15 species of butterflies and moths on the Refuge.

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 Navy and Refuge staff to monitor and control mosquito populations on Naval Weapons Station Seal Beach. 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 here (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 very 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 has highly contrasting black and white coloration. Larvae develop in upper portions of salt marshes within pickleweed that has been flooded by high tides. Although not considered a vector, this species is an aggressive biter, and can be troublesome to coastal 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 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 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 ().

Of the species outlined, 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 Naval Weapons Station Seal Beach 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.

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 1991). 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 1991). 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. 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.

A number of fish collected in the early 1970s 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 10 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.

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 1991).

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)

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 defined to address Habitat Areas of Particular Concern (HAPC). HAPC, identified in specific fish management plans to help provide additional focus for conservation efforts, consist of areas supporting ecological functions that are very 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 (NMFS 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° Celsius. 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 in this section. 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 10 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.

California least tern on NASA Island (K. Gilligan/ USFWS)

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 2006b), 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 (Marschalek pers. comm. 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 like Anaheim Bay;
- Protect and manage adequate feeding habitat for least tern 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 least tern nesting site has been monitored annually since 1998, and the data from this monitoring effort is presented in Table 4-8. As indicated in the Table 4-8, the number of breeding pairs and the number of fledglings at NASA Island fluctuate from year to year, which are the result of various factors including food supply, predation, and changes in nest site conditions. For example, 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).

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](pers. comm. Marschalek 11/17/10)

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.

"Eyes on the Colony" volunteer watching over the Refuge's least tern colony (Tim Anderson)

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 Naval Weapons Station Seal Beach (USFWS and U.S. Navy 1991).

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.

Light-footed clapper rail (Tim Anderson)

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, 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 and 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 to 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. Figure 4-14 presents the results of spring call counts and high tide counts for the Refuge from 1980 to 2005.

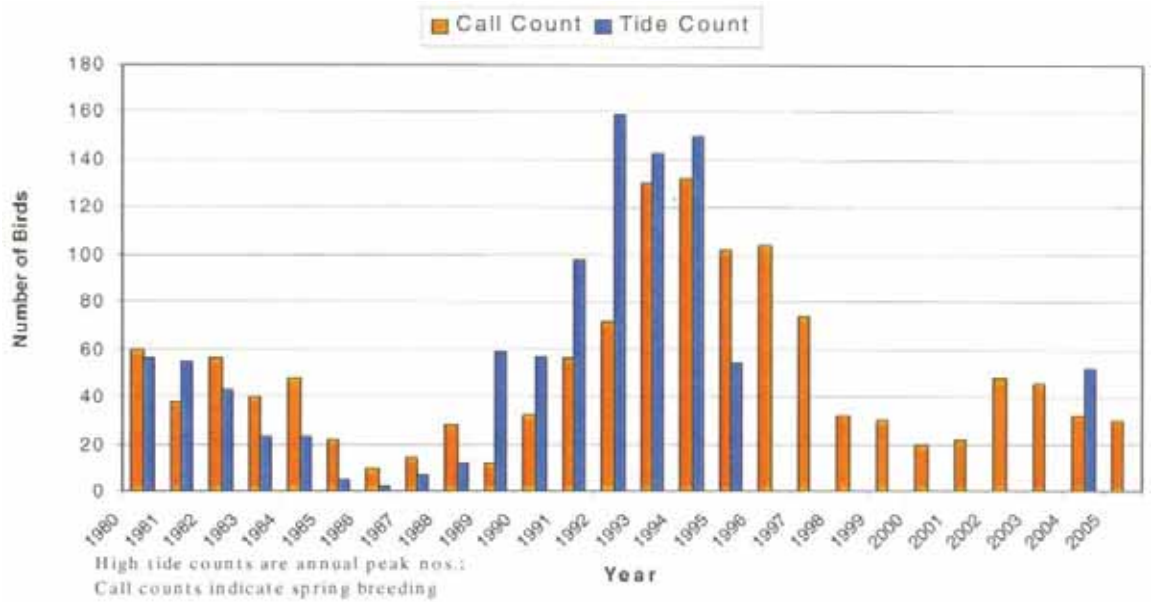

Figure 4-14. Light-footed Clapper Rail Counts on Seal Beach NWR, 1980-2005

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 (Zembal et al. 2007), while in 2008, only 20 rails were documented during the fall high tide count and the 2008 spring call count identified only one breeding pair (Hoffman 2009). A total of 50 rails were identified in 2009 during the fall high tide count and 12 breeding pairs were detected during the spring call count.

As indicated in Table 4-9, which provides the breeding pair estimates for the Refuge between 1980 and 2008, the Refuge's rail population suffered two drastic declines during this period. Non-native red fox predation nearly eliminated the population in the 1980s. In 1984, 24 pairs were identified, 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 again dropped; this time 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 at night and in fall or winter during the early morning, force rails to move to higher ground with little cover (Zembal et al. 2006), exposing them to potential predators.

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)

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

An older version of our nesting platform; some are still in use today (John Fitch)

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.

2012 model of our rail nesting platform (K. Gilligan/USFWS)

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, 11 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 Naval Weapons Station Seal Beach 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).

Western snowy plover (John Fitch)

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 had been documented on the Refuge until 2011, when the first snowy plover nest was discovered on NASA Island. Although foraging opportunities exist for this plover within Anaheim Bay, only a few observations of this bird are made annually on the Refuge, and these observations have generally been 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 (NMFS 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 (NMFS and USFWS 1998). The East Pacific green turtle, with its heart-shaped shell, small head, and single-clawed flippers, is also conspicuously smaller and lighter than the green turtle. 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 (e.g., 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 percent) 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. In 2011, NOAA National Marine Fisheries Service initiated monitoring of sea turtle activity on the Refuge.

4.3.6 State Listed Species

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

4.3.6.1 Belding's Savannah Sparrow (*Passerculus sandwsis 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-dependent 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, which 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), is a small brown sparrow with fine streaking on the head and face and pale beige to white on its 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.

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."

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)

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 Navy lands.

The long-billed curlew, a Bird of Conservation Concern, is a regular, seasonal visitor to the Refuge (Tim Anderson)

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 State or Federal Endangered Species Acts;
- State or Federal candidate for possible listing;
- Meet the listing criteria, even if not currently included on a list;
- California Species of Special Concern;
- Biologically rare, 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;
- Associated with rapidly declining habitat in California; and
- Designated as a special status, sensitive, or declining species by another Federal/State agency or non-governmental organization.

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
Common yellowthroat	*Geothlypis trichas sinuosa*	Uplands	Occasional	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]
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 State also maintains a special plants list entitled "Special Vascular Plants, Bryophytes, and Lichens List" (CDFG 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, Service, 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 that 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 National Wildlife Refuge

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
REPTILES	
Aspidoscelis hyperythra	orange-throated whiptail
Chelonia mydas	eastern Pacific green sea turtle
Phrynosoma coronatum blainvillii	coast (San Diego) horned lizard

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

Scientific Name	Common Name
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 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 effects 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 adjacent Navy lands was the red fox. This subspecies 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 Naval Weapons Station Seal Beach. 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 adjacent Navy lands, 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 1991). As a result of this management plan, the non-native red fox is no longer present on Naval Weapons Station Seal Beach, including 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 Naval Weapons Station Seal Beach.

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 and 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 in this section, 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 descendants, 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 Anaheim 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 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 Naval Weapons Station Seal Beach in 1944 and began creation of a harbor and the construction of wharves. After World War II, Naval Weapons Station Seal Beach 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 Naval Weapons Station Seal Beach that are now included in the Refuge were used for a variety of military purposes, including clean fill disposal, 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 Naval Weapons Station Seal Beach, 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 Naval Weapons Station Seal Beach 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 date for sites located to the west of Naval Weapons Station Seal Beach (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).

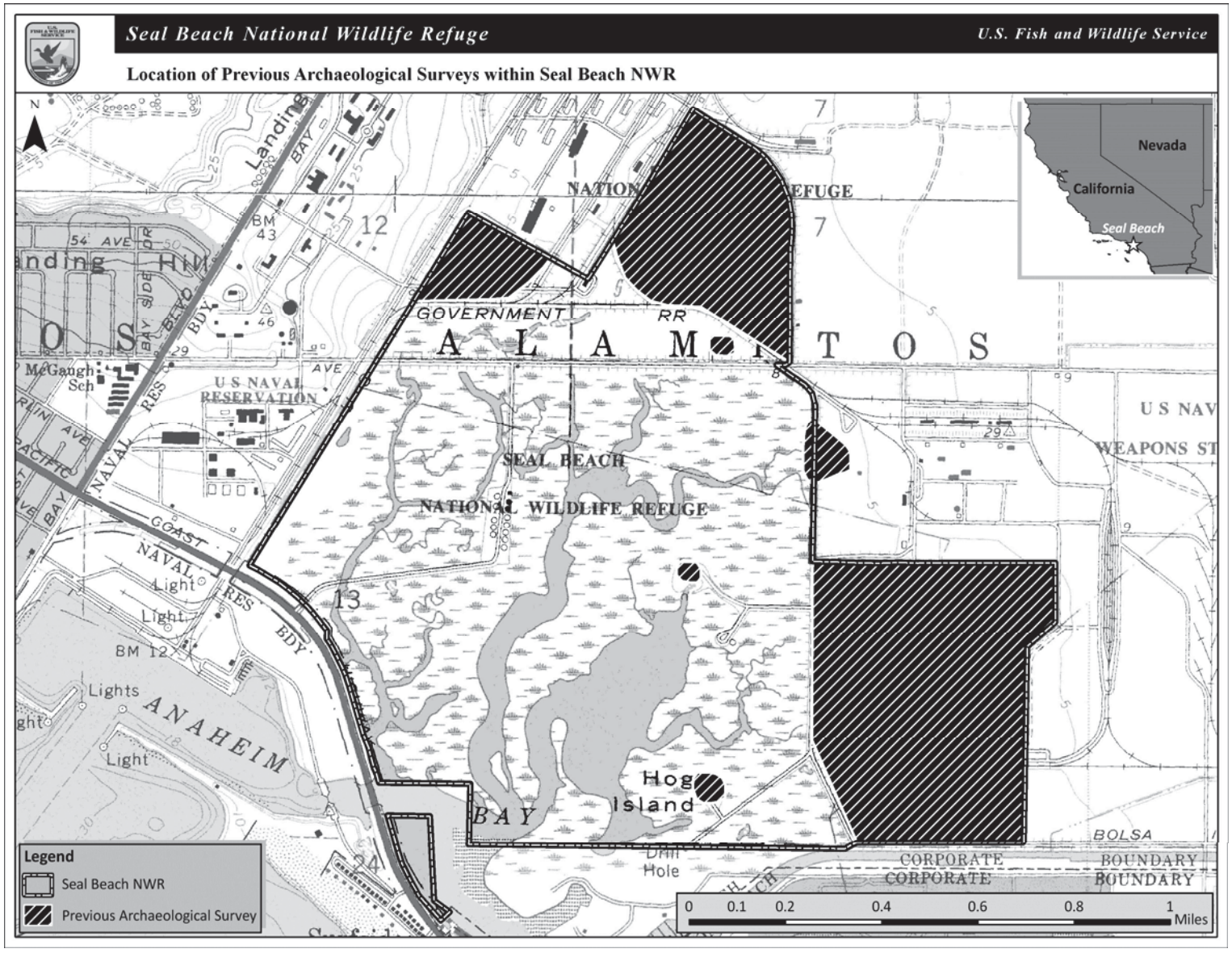

Figure 4-15. Location of Previous Archaeological Surveys at Seal Beach NWR

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 for the Naval Weapons Station Seal Beach. No sacred lands were identified.

Two studies of historic buildings and structures at Naval Weapons Station Seal Beach 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 Naval Weapons Station Seal Beach. 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 Naval Weapons Station Seal Beach 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 Naval Weapons Station Seal Beach, 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 Naval Weapons Station Seal Beach and the Regional Director of the

Welcome to the Seal Beach NWR (K. Gilligan/USFWS)

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 Naval Weapons Station Seal Beach'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 Naval Weapons Station Seal Beach is always subject to change due to ongoing security concerns.

Except in times of increased security, the Refuge offers monthly tours to the public. These tours, led by the Friends of the Seal Beach NWR and Refuge staff, are conducted in cooperation with the Navy and include a three-hour walking tour through a portion of the Refuge. Occasional birding tours are also conducted on the Refuge throughout the year, and an off-site environmental education program is conducted by the Friends.

The Friends of the Seal Beach NWR welcome visitors and share their knowledge (USFWS)

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 Naval Weapons Station Seal Beach. The Refuge is surrounded by military activities occurring on Naval Weapons Station Seal Beach. These activities include maintaining 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 maintenance and storage buildings, railroad track, and 68 miles of paved road.

In addition to the developed areas, more than 2,000 acres of open land 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 Naval Weapons Station Seal Beach, but outside the Refuge boundary, is oil production. When the Federal government condemned the land occupied by Naval Weapons Station 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 1991). 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).

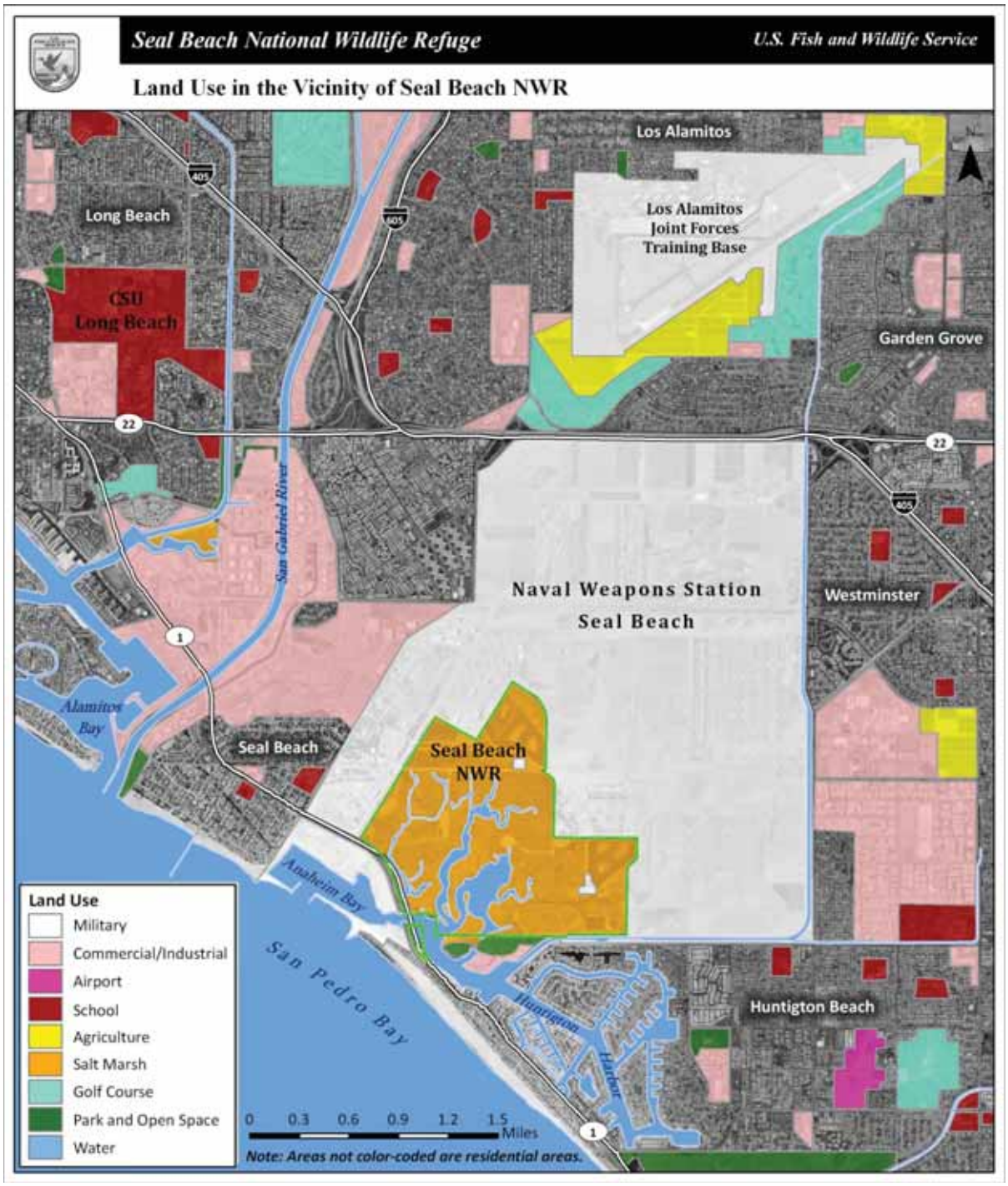

Figure 4-16. Land Use in the Vicinity of Seal Beach NWR

Uses Beyond Naval Weapons Station Seal Beach. The properties immediately surrounding Naval Weapons Station Seal Beach 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 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 Naval Weapons Station Seal Beach are highly urbanized areas with about 18 million people living within about a two-hour drive of the Refuge. Naval Weapons Station Seal Beach 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 is the City of Garden Grove, to the east is the City of Westminster, and to the south is 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 Refuge.

4.5.2 Public Safety

The military mission at Naval Weapons Station Seal Beach 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 Naval Weapons Station Seal Beach 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—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 Naval Weapons Station Seal Beach, there is a potential for buried and unburied unexploded ordnance on the Refuge. Two Munitions Response Program Sites, described in the Contaminants section, are documented on the Refuge. These sites are known to contain munitions debris and therefore could pose a safety threat. As a result, the Navy must approve activities proposed in sites with the potential to contain munitions and for 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 (four lanes divided) there is insufficient capacity on Pacific Coast Highway to accommodate existing and future traffic volumes.
From these regional corridors, visitors would likely use Seal Beach Boulevard or Westminster Avenue to get to approved parking areas on Naval Weapons Station Seal Beach. 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 Naval Weapons Station Seal Beach. 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 then 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 3.7.4). The county actively works with Naval Weapons Station Seal Beach and Refuge staff to monitor and, when necessary, control mosquito populations on Navy and 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 Naval Weapons Station Seal Beach. In addition, staff from Naval Weapons Station Seal Beach Environmental Programs and Services Office provides assistance with management actions.

Table 4-15
Economic/Employment Data for Orange County, California

Annual Industry Distribution of Jobs and Avg. Wage in 2006 (NAICS)	Establishments	Jobs	Percent 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, excluding public administration	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.

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.

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**

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. 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 40 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).

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.

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.

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 Plan Implementation

5.1 Introduction

This final Comprehensive Conservation Plan (CCP) will serve as the primary reference document for all Refuge planning, operations, and management to be implemented on the Seal Beach NWR through fiscal year 2026. The Service will implement this CCP with assistance from existing and new partners, including public agencies (e.g., Naval Weapons Station Seal Beach, California Department of Fish and Game, NOAA National Marine Fisheries Service) and non-governmental organizations, including the Friends of Seal Beach National Wildlife Refuge, as well as tribes, adjacent property owners, and other interested individuals. Consistent public outreach and continued coordination with Refuge constituents are essential components of this implementation process.

The CCP provides long-term guidance for management decisions and sets forth the vision, goals, objectives, and strategies needed to accomplish the purposes for which the refuge was established. Although it is our intent to implement the various strategies by the dates presented in Chapter 3, the timing of implementation will likely vary depending upon a variety of factors, including funding, staffing, compliance with Federal regulations, partnerships, and the results of monitoring and evaluation. The timing and achievement of management strategies are contingent upon such factors as funding and staffing, completion of step-down plans, compatibility determinations, compliance requirements, adaptive management, and monitoring. For example, the implementation of the habitat restoration proposals in this CCP will require the allocation of significant funding, the preparation of step-down restoration plans, coordination with Naval Weapons Station Seal Beach, and completion of appropriate environmental compliance documents before they can be implemented. The factors affecting the completion of Refuge strategies are briefly described in this chapter.

5.2 Refuge Goals, Objectives and Strategies

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 the National Wildlife Refuge System (Refuge System, NWRS) mission and goals. A detailed discussion of the goals, objectives, and strategies is provided in Chapter 3.

5.3 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.

5.4 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 plan provides for ongoing adaptive management of the Refuge, such as is described in Objectives 2.2 and 2.3 (refer to Chapter 3).

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.

5.5 CCP Revision Process

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 every five years) to address needs identified as a result of monitoring or in response to adaptive management procedures, as described previously.

The 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 National Environmental Policy Act (NEPA) documentation will be determined by the Refuge Manager.

5.6 Partnership Opportunities

The primary partners currently assisting in the management of this Refuge include Naval Weapons Station Seal Beach and the Friends of Seal Beach NWR. Naval Weapons Station Seal Beach contributes funding and/or personnel to assist in various aspects of Refuge management, including but not limited to predator management, contaminant assessment and clean-up, 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 in Chapter 3. 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 (NOAA) Restoration Center, as well as non-governmental organization partners such as the California Waterfowl Association, who assisted in the design of the restoration concepts described in the CCP. Other partners will assist in monitoring habitat function and species abundance and diversity. Such partners may include NOAA National Marine Fisheries Service, United States Geological Survey (USGS), and various researchers. As the CCP is implemented, the Refuge will seek additional partners to assist with visitor services and public outreach, research, surveys, and monitoring and with addressing regional issues such as water quality.

5.7 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. One step-down plan has been prepared as part of this CCP, an Integrated Pest Management Plan, provided as Appendix G and summarized here.

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 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, where necessary. It also describes the approval processes 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 to the Project Leader, Regional Office, or Washington Office level. Pesticide use will also conform to the Navy's approved IPM Plan for Naval Weapons Station Seal Beach, and pesticide applications will be documented on the Navy Online Pesticide Reporting System.

The primary focus of the Seal Beach NWR IPM Plan is on controlling invasive upland plants. The IPM Plan will continue to be reviewed and updated as needed to address new information and policy changes.

Predator Management Plan

A predator management plan (described in detail in Chapter 3) was previously prepared and approved for the Refuge in 1991 and will continue to be implemented as part of the approved CCP.

Fire Management Plan

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 I). 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, Naval Weapons Station Seal Beach has prepared a comprehensive fire management plan for the Naval Weapons Station 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.

Several additional step-down plans are proposed for completion following the approval of the CCP. Table 5-1 lists these step-down plans along with the target dates for completion.

Table 5-1
Step-down Plans Proposed for the Seal Beach NWR

Plan	*Target for Completion*
Habitat Management Plan	2014
Habitat Restoration Plans for areas around Case Road Pond and 7th Street Pond	2015/2017
Mosquito Management Plan	To be determined – will follow Service approval of the Mosquito and Mosquito-Borne Disease Policy for the NWRS

5.8 Compliance Requirements

5.8.1 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 to 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 and 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 (CZMA) 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 J.)

5.8.2 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 D) to the Regional Cultural Resources Team, which will determine if consultation with the California State Historic Preservation Officer is required.

- **U.S. Navy, Naval Weapons Station Seal Beach** – Refuge staff will continue to coordinate with the appropriate offices at Naval Weapons Station Seal Beach, as described in the General Plan and Management Plan prepared in association with Refuge establishment, on issues related to the Installation Restoration Program/Munitions Response Program, pesticide use, restoration/enhancement projects, predator management, and listed species.

  Coordination procedures will be more formally defined in a forthcoming Memorandum of Understanding (MOU) between Naval Weapons Station Seal Beach and the San Diego National Wildlife Refuge Complex. The MOU is expected to describe when and to what extent project coordination will occur between the Navy and the Service, as well as define Refuge 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 will also be described.

- **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 of 1972.

5.8.3 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 here.

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 Attachment B of Appendix G);

- Include in the SUP that is issued annually to the OCVCD the BMPs presented in Section 3.7.4 (Mosquito Management), the stipulations included in the Compatibility Determination for Mosquito Management (Appendix E-3); and any specific BMPs required as part of the PUPS approval process for specific 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 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 minimize the adverse effects of soil disturbance and to avoid impacts to surrounding vegetation;
- Carry out the appropriate BMPs, as outlined in the IPM Plan (Appendix G), the Compatibility Determination for Mosquito Management (Appendix E-3), and Section 3.7.4 (Mosquito Management) when applying herbicides or pesticides; 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 or 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 and runoff, and to contain spills;
    - Inspect construction vehicles and equipment for leaks prior to each day of use and immediately implement repairs if a leak is discovered,; 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 needed
    - installing wind fencing, if deemed necessary
    - stopping work during high wind conditions;
- Cover piles of excavated material with a tarp or other;
- Revegetate disturbed construction sites with appropriate 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 sweep 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 South Coast Air Quality Management District (SCAQMD) air quality standards; and
- Carry out the appropriate BMPs, as outlined in the IPM (Appendix G), Compatibility Determination for Mosquito Management (Appendix E-3), and Section 3.7.4 (Mosquito Management), when applying herbicides or pesticides.

5.9 Refuge Operations

5.9.1 Funding and Staffing

For fiscal year (FY) 2010, the general operating costs (excluding staff costs, which are discussed here) 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 Fiscal Year (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 that were included in the SAMMS database prior to the approval of the CCP total 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. These proposals are presented in Table 5-2, with the projects 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.

Table 5-2
Proposed Update to the SAMMS Database
Deferred Maintenance and New Construction Projects
Based on the Proposal in the CCP

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)	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 non-native 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 restroom 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		**$4,193,000**	**$16,500**

The RONS database will also be updated as indicated in Table 5-3 to reflect the projects included in the approved CCP. For each project, the corresponding CCP objective (see Chapter 3) is noted. The projects listed in Table 5-3 are presented in order of priority (from highest to lowest) within the Refuge. To fully implement the proposed actions and achieve the goals and objectives of the CCP, additional staff will be necessary, as presented in Table 5-4.

Table 5-3
Proposed Update to the RONS Database
Based on the Proposals in the CCP

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 non-native 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

Table 5-3 Proposed Update to the RONS Database Based on the Proposals in the CCP			
Proposed RONS Projects (presented in order of priority)	**Corresponding CCP Objective**	**Operating Costs**	
		First Year Cost	Recurring Annual Cost
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
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**

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 Refuge Complex staff are dedicate to the operations at Seal Beach NWR are reflected in Table 5-4, as are the current and 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 the position cannot be filled, some aspects of the Plan may not be completed within the timeframe presented. The estimated cost of providing the staffing needs for maintaining and operating the Seal Beach NWR is approximately $340,000.

Table 5-4 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.

5.9.2 Compatibility and Appropriate Use Determinations

As described in Chapter 1, the Refuge Improvement Act requires that all uses permitted on a national wildlife refuge 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 and research. All of these documents were provided for public review and comment. The final determinations are provided in Appendix E.

6 References Cited

American Ornithologists' Union (AOU). 1983. Check-list of North American Birds, 6th ed. American Ornithologists' Union, Washington, D.C.

Anderson, J., F. Chung, M. Anderson, L. Brekke, D. Easton, M. Ejeta, R. Peterson, and R. Snyder. 2008. "Progress on Incorporating Climate Change into Management of California's Water Resources," in *Climatic Change*, Springer, Netherlands, Volume 89, Supplement 1, March 2008. Published online 12-22-2007. ISSN: 0165-0009 (Print) 1573-1480 (Online). DOI: 10.1007/s10584-007-9353-1.

Assis De Moraes, A. P. 1977. Flies (Diptera) Attracted to Blacklight at the Anaheim Bay Salt Marsh, California. Unpublished Master's Thesis, California State University, Long Beach. Long Beach, CA. 50 pp.

Atwood, J.L. and P.R. Kelly. 1984. Fish dropped on breeding colonies as indicators of least tern food habits. *Wilson Bulletin* 96:34-47.

Baker, P. C. 1975. The Vascular Plants of the Salt Marsh. In Lane, E.D. & C.W. Hill, eds. The Marine Resources of Anaheim Bay. California Department of Fish and Game, Fish Bulletin 165.

Bean, L. J. and C. R. Smith. 1978. Gabrieliño. In *Handbook of North American Indians*, *California Volume 8*. pp. 538-549. Robert F. Heizer, editor. Smithsonian Institution, Washington, D.C.

Bierbaum, R. M., J. P. Holdren, M. C. MacCracken, R. H. Moss, and P. H. Ravens (eds). 2007. Confronting Climate Change Avoiding the Unmanageable and Managing the Unavoidable. Report prepared for the United Nations Commission on Sustainable Development. Sigma Xi, Research Triangle Park, NC, and the United Nations Foundation, Washington DC.

Bradley, R.A. 1973. "A population census of the Belding's savannah sparrow (*Passerculus sandwichensis beldingi*)." *Western Bird Bander* 48(3):40-43.

Brennan, P. 2007. The San Gabriel River's wild youth, in The Orange County Register, July 2, 2007. Orange County Register accessed at http://legacy.sfei.org/inthenews/July0207_ocregister_San%20Gabriel%20River.pdf.

Brock, J. 1985. Cultural Resource Assessment of Two Study Areas in the Seal Beach National Wildlife Refuge. Archaeological Advisory Group, Long Beach, California. On file at South Central Coastal Information Center.

Brown, S., C. Hickey, B. Harrington, and R. Gill, eds. 2001. The U.S. Shorebird Conservation Plan, 2nd ed. Manomet Center for Conservation Sciences, Manomet, MA.

Caffrey, Carolee. 1994. California Least Tern Breeding Survey, 1993 Season. Prepared for the California Department of Fish and Game. Nongame Bird and Mammal Section Report, 94-07.

CALFED Independent Science Board. September 6, 2007. Sea Level Rise and Delta Planning. http://science.calwater.ca.gov/pdf/isb/meeting_082807/ISB_response_to_ls_sea_ level_ 090707.pdf

California Audubon Society Important Bird Areas (website). http://ca.audubon.org/iba/iba_sites.shtml

California Department of Conservation. 2007. Orange County Important Farmland 2006. Division of Land Resource Protection, Farmland Mapping and Monitoring Program, Sacramento, California.

California Department of Conservation. 2009. Farmland Mapping and Monitoring Program Soil Candidate Listing for Prime Farmland and Farmland of Statewide Importance, Orange County. Published on July 19, 1995; updated on August 11, 2009.

California Department of Fish and Game (CDFG). 1975. The Marine Resource of Anaheim Bay. Fish Bulletin 165. E. David Lane and Cliff W. Hill editors.

California Department of Fish and Game (CDFG). 2007. California Wildlife: Conservation Challenges (California's Wildlife Action Plan). Prepared by UC Davis Wildlife Health Center, D. Bunn, A. Mummert, M. Hoshovsky, K. Gilardi, and S. Shanks.

California Department of Fish and Game (CDFG). 2009. California Natural Diversity Database, Special Animals (883 taxa) Natural Resources Agency, Department of Fish and Game, Biogeographic Data Branch.

California Department of Fish and Game, Natural Diversity Database. January 2010. Special Vascular Plants, Bryophytes, and Lichens List. Quarterly publication.

California Department of Fish and Game and U.S. Fish and Wildlife Service (CDFG and USFWS). 1976. The Natural Resources of Anaheim Bay.

California Energy Commission. 2006. Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004.

California, State of. Office of Planning and Research. 2008. Technical Advisory - CEQA and Climate Change: Addressing Climate Change through California Environmental Quality Act (CEQA) Review. June 19, 2008.

California State Water Resources Control Board (SWRCB). 2009. Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality. California Environmental Protection Agency.

California Water Boards. 2007. Surface Water Ambient Monitoring Program Report: Anaheim Bay and Huntington Harbour Sediment and Water Column Toxicity Study. Prepared by Pavlova Vitale, Environmental Scientist, Santa Ana Regional Water Quality Control Board. June 7, 2007.

Cayan, Dan. 2009. "Climate Change – What Southern California Should Prepare for?" in *Climate Change and the Future of Southern California*. Southern California Association of Governments. July 2009.

CCSP. 2008. *Preliminary review of adaptation options for climate-sensitive ecosystems and resources.* A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. [Julius, S.H., J.M. West (eds.), J.S. Baron, B. Griffith, L.A. Joyce, P. Kareiva, B.D. Keller, M.A. Palmer, C.H. Peterson, and J.M. Scott (Authors)]. U.S. Environmental Protection Agency, Washington, DC, USA.

ChaduxTt (A Joint Venture of St. George Chadux Corp. and Tetra Tech EM Inc.). 2011. Final Site Inspection Report for Munitions Response Program Sites UXO1, UXO2, UXO6, AOC1, and AOC2 Naval Weapons Station Seal Beach, California. Prepared for Department of the Navy, NAVFAC Southwest San Diego, California 92132.

Chan, K.M. and E.D. Lane. 1975. Physical and chemical study of the Anaheim Bay salt marsh. In Lane, E.D. & C.W. Hill, eds. The Marine Resources of Anaheim Bay. California Department of Fish and Game, Fish Bulletin 165.

City of Seal Beach. 2003. City of Seal Beach General Plan.

Clevenger, J., and K. A. Crawford. 1997a. Historic Properties Overview and Evaluations on the Naval Weapons Station, Seal Beach. Prepared by Ogden Environmental and Energy Services Co., Inc., for the Southwest Division, Naval Facilities Engineering Command, San Diego.

Clevenger, J., and K. A. Crawford. 1997b. Final Historic and Archaeological Resources Protection (HARP) Plan for the Naval Weapons Station, Seal Beach. Prepared by Ogden Environmental and Energy Services Co., Inc. for the Southwest Division, Naval Facilities Engineering Command, San Diego.

Coastal Resources Center, University of Rhode Island and International Resources Group (CRC&IRG). 2009. Adapting To Coastal Climate Change: A Guidebook for Development Planners.

Collier, Christine L. and Powell, Abby N. 1998. Reproductive Success of Belding's Savannah Sparrows in a Highly Fragmented Landscape. The Auk 115(2):508-513. Jamestown, ND: Northern Prairie Wildlife Research Center
Online. http://www.npwrc.usgs.gov/resource/birds/belding/index.htm (Version 18MAY98).

Collins, C. T. 2007. Biology of the California Least Tern at Naval Weapons Station Seal Beach, in the 2003 to 2007 Breeding Seasons. Unpublished report prepared for the Environmental Core Naval Facilities Engineering Command Southwest, San Diego, California under agreement with California State University Long Beach Foundation, Long Beach, California.

Comrack, L., B. Bolster, J. Gustafson, D. Steele, and E. Burkett. April 10, 2008. Species of Special Concern: A Brief Description of an Important California Department of Fish and Game Designation. California Department of Fish and Game, Wildlife Branch, Nongame Wildlife Program Report 2008-03, Sacramento, CA.

Cornell Lab of Ornithology. 2003. All About Birds (website). http://www.birds.cornell.edu/AllAboutBirds/BirdGuide/Nelsons_Sharptailed_Sparrow_dtl.html.

Cottrell, M. and T. Cooley. 1980. Report of an Archaeological Resources Survey of a 160 Acre Portion of the Seal Beach National Wildlife Refuge, Seal Beach, California. Archaeological Resource Management Corp., Garden Grove, California.

Craig, A.M. 1971. Survey of California least tern nesting sites. California Department of Fish and Game, Special Wildlife Investigation, Project W-54-R-4, Final Report, Job II-5.1.

DMG. 1998. California Department of Conservation, Division of Mines and Geology. Seismic Hazard Zone Report for the Seal Beach 7.5-Minute Quadrangle, Los Angeles and Orange Counties, California. Seismic Hazard Zone Report 020.

Drover, C.E., H.C. Koerper, and P. Langenwalter II. 1983. Early Holocene Human Adaptation on the Southern California Coast: A Summary Report of Investigations at the Irvine Site (CA-ORA-64), Newport Bay, Orange County, California, *Pacific Coast Archeological Society Quarterly*, 19(3)&4):1-84.

Erlandson, Jon M. 1994. *Early Hunter-Gatherers of the California Coast*. Plenum Press, New York.

Everest. 2007. Consultation Related to Ongoing Erosion in Restored Salt Marsh Habitat on the Seal Beach National Wildlife Refuge for the Seal Beach National Wildlife Refuge Comprehensive Conservation Plan. Everest International Consultants, Inc. Submitted to the U.S. Fish and Wildlife Service. August 30.

Faber, T. A. & Kuo, F.E. 2009. "Children with attention deficits concentrate better after walk in the park." Journal of Attention Disorders, 12, 402-409

Fancher, J. M. 1992. Population status and trends of the California Least Tern. Transactions of the Western Section of the Wildlife Society 28:59-66.

Glassow, M. A., L. Wilcoxon, and J. Erlandson. 1988. Cultural and Environmental Change during the Early Period of Santa Barbara Channel Prehistory. In *The Archaeology of Prehistoric Coastlines*, edited by Geoff Bailey and John Parkington, pp. 64-77. Cambridge University Press, New York.

Glassow, Michael A. 1980. Recent Developments in the Archaeology of the Channel Islands. In The California Islands, an Interdisciplinary Symposium, edited by D.M. Power, pp. 79-99. Santa Barbara Museum of Natural History, Santa Barbara.

Goals Project. 2000. Baylands Ecosystem Species and Community Profiles: Life histories and environmental requirements of key plants, fish and wildlife. Prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project. P.R. Olofson, editor. San Francisco Bay Regional Water Quality Control Board. Oakland, California.

Heberger, Matthew, Heather Cooley, Pablo Herrera, Peter H. Gleick, and Eli Moore. 2009. The Impacts of Sea-Level Rise and the California Coast. A Paper from the California Climate Change Center, prepared by members of the Pacific Institute. Oakland California.

Hickey, C., W.D. Shuford, G.W. Page, and S. Warnock. 2003. Version 1.1. The Southern Pacific Shorebird Conservation Plan: A strategy for supporting California's Central Valley and coastal shorebird populations. PRBO Conservation Science, Stinson Beach, CA.

Hoffman, Susan. 2009. Light-footed Clapper Rail Management at Seal Beach National Wildlife Refuge, 2008 (draft). Prepared for the USFWS, NWS Seal Beach, and Naval Facilities Engineering and Command Southwest.

Intergovernmental Panel on Climate Change (IPCC). 2007a. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press.

Intergovernmental Panel on Climate Change (IPCC). 2007b. Climate Change 2007b: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change [Parry, Martin L., Canziani, Osvaldo F., Palutikof, Jean P., van der Linden, Paul J., and Hanson, Clair E. (eds.)]. Cambridge University Press, Cambridge, United Kingdom.

James, R. and D. Stadtlander. 1991. A survey of the Belding's savannah sparrow (*Passerculus sandwichensis beldingi*) in California, 1991. A report of the California Department of Fish and Game, Nongame Bird and Mammal Section Report 91-05.

Jirik, KE and CG Lowe. First reported occurrences of the green sea turtle, *Chelonia mydas*, in the Anaheim Bay Estuary (Seal Beach, California). In review.

Johnson, J. 1987. Correlations between vegetative characteristics of six salt marshes and Belding's sparrow densities. M.Sc. thesis. Calif. State University, Los Angeles.

Jones, Terry L. 1992. Settlement Trends along the California Coast. In Essays on the Prehistory of Maritime California, edited by Terry L. Jones, pp.1-38. No. 10, Center for Archaeological Research at Davis, University of California at Davis.

JRP Historical Consulting Services. 1999. National Register of Historic Places Evaluation of Cold War-Era Buildings and Structures. Naval Weapons Station, Seal Beach, Orange County, California.

Keane, K. 1999. California Least Tern Breeding Survey 1998 Season. Final Report to California Department of Fish and Game, Sacramento (Contract FG6138).

Kellogg, M. G. 1980. "Status of the California Brackishwater Snail, *Tryonia imitator,* in Central California." Inland Fisheries Endangered Species Program, Special Publication 80-3. California Department of Fish and Game: Sacramento, CA.

Klingbeil, R. A., R. D. Sandell and A. W. Wells. 1975. An annotated checklist of the elasmobranchs and teleosts of Anaheim Bay. In E.D. Lane, C.W. Hill, eds., the Marine Resources of Anaheim Bay. California Department of Fish and Game, Fish Bulletin 165.

Kroeber, A. L. 1925. *Handbook of the Indians of California.* Bureau of American Ethnology Bulletin 78. Smithsonian Institution, Washington.

Kus, B.E. 1990. Status of the Belding's savannah sparrow (*Passerculus sandwichensis beldingi*) at the Tijuana Estuary, 1990. Prepared for the Dept. of the Army, Corps of Engineers, Los Angeles District, Los Angeles, California.

Kushlan, J.A., J. Steinkamp, K.C. Parsons, J. Capp, M. Acosta Cruz, M. Coulter, I. Davidson, L. Dickson, N. Edelson, R. Elliot, R. M. Erwin, S. Hatch, S. Kress, R. Milko, S. Miller, K. Wheeler, and K. Wohl. 2002. Waterbird Conservation for the Americas: The North American Waterbird Conservation Plan, Version 1. Waterbird Conservation for the Americas, Washington, DC, U.S.A.

Lane, E. David. 1975. Early Collections of Fishes from Anaheim Bay Made Between 1919 and 1928. In The Marine Resource of Anaheim Bay. Fish Bulletin 165. California Department of Fish and Game. 1975. E. David Lane and Cliff W. Hill editors.

Lane, J. M. and Alan Woods. 1975. A History of Anaheim Bay. In The Marine Resource of Anaheim Bay. Fish Bulletin 165. California Department of Fish and Game. 1975. E. David Lane and Cliff W. Hill editors.

Lavender, D. 1987. *Historical Narrative, Rancho Los Alamitos*. Rancho Los Alamitos Foundation, Long Beach, California.

Longhurst, A.R. 1969. The status of an endangered bird (*Sterna albifrons*) in San Diego County, 1969. U.S. Bureau of Commercial Fisheries, La Jolla, California Unpublished report. Management Plan.

Louv, R. 2005. Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder. Chapel Hill, NC: Algonquin Books of Chapel Hill.

Marschalek, Daniel A. 2008. California Least Tern Breeding Survey – 2007 Season. State of California, The Resources Agency, Department of Fish and Game, Wildlife Branch. Nongame Wildlife Program 2008-01.

Marschalek, D.A. 2009. California least tern breeding survey, 2008 season. California Department of Fish and Game, Wildlife Branch, Nongame Wildlife Program Report, 2009-02. Sacramento, CA.

Marschalek, D.A. 2010. California least tern breeding survey, 2009 season. California Department of Fish and Game, Wildlife Branch, Nongame Wildlife Program Report, 2010-03. Sacramento, CA.

Mason, R.D. and M.L. Peterson. 1994. Newport Coast Settlement Systems: Analysis and Discussion, Volume I. Prepared for Coastal Community Builders, Newport Beach, California. Prepared by The Keith Companies, Costa Mesa.

Massey, B.W. 1974. Breeding biology of the California least tern. *Proc. Linnaean Soc*. 72:1-24.

Massey, B.W. 1976. Vocal differences between American least terns and the European little tern. *Auk* 93(4):760-773.

Massey, B.W. 1979. Belding's Savannah Sparrow. Contract No. DACW09-78-C-0008, U.S. Army Corps of Engineers, Los Angeles District.

Massey, B.W. 1985. The Status of the Light-footed Clapper Rail and Salt Marsh Bird's Beak in Anaheim Bay, Orange County, California, 1985. Prepared for USFWS.

Massey, B.W. 1987. The Status of the Light-footed Clapper Rail and Salt Marsh Bird's Beak in Anaheim Bay, Orange County, California, 1986. Prepared for USFWS.

Massey, B.W. and J.L. Atwood. 1981. Second-wave nesting of the California least tern: age composition and reproductive success. *Auk* 98:596-605.

Massey, B.W.; R. Zembal, and P.D. Jorgensen. 1984. Nesting habitat of the Light-footed Clapper Rail in Southern California. *Journal of Field Ornithology* 55(1): 67-80.

MEC Analytical Systems, Inc. 1995. Anaheim Bay Biological Monitoring Project. Final Report. Prepared for the Port of Long Beach.

Migliarese, N.L. 2008. Researching the Child ~ Nature Connection. California State Parks. (Available at www.parks.ca.gov)

Moffatt & Nichol, Engineers. 1987. Anaheim Bay Mitigation Project, Final Report. Prepared for the Port of Long Beach.

Moffatt & Nichol, Engineers. 1988. Anaheim Bay Mitigation Project (Construction Plans). Prepared for the Port of Long Beach. April 1988.

Nagano, Christopher D. 1980. Population Status of the Tiger Beetles of the Genus Cicindela (Coleoptera: Cicindeliedae) Inhabiting the Marine Shoreline of Southern California. Atala (Journal of the Xerces Society) 8(2):33-42.

National Invasive Species Council. 2008. 2008-2012 National Invasive Species Management Plan. National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service Essential Fish Habitat Webpage: http://www.nmfs.noaa.gov/habitat/habitatprotection/efh/index.htm.

National Marine Fisheries Service (NMFS). 2005. Pacific Coast Groundfish Fishery Management Plan Essential Fish Habitat Designation and Minimization of Adverse Impacts Final Environmental Impact Statement. NMRS, Northwest Region. Seattle, WA.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service. 1998. Recovery Plan for U.S. Pacific Populations of the East Pacific Green Turtle (*Chelonia mydas*). National Marine Fisheries Service, Silver Spring, MD.

National Marine Protected Areas Center. 2008. Framework for the National System of Marine Protected Areas of the United States of America. NOAA's Office of Ocean and Coastal Resource Management. Silver Spring, Maryland.

Naval Energy and Environmental Support Activity. 1985. Initial Assessment Study, Naval Weapons Station, Seal Beach California. UIC: N60701.

Orange, County of. No date. Hydrological Data Report 2004-2005 Season, Volume XLI. Resources and Development Management Department.

Orange County Vector Control District (OCVCD). 2010. Integrated Vector Management and Response Plan.

Orange County Vector Control District (OCVCD). No Date. Mosquitoes of Orange County. Available at: http://www.ocvcd.org/bulletins/Mosquitoes%20of%20O.%20C%202006-M5.pdf

Orange County. 2009. Final Draft North Orange County Integrated Regional Water Management Plan. Orange County Watersheds Program.

Pacific Fishery Management Council. 1998. Coastal Pelagic Species Fishery Management Plan. Portland. OR. Available on-line at: http://www.pcouncil.org/coastal-pelagic-species/fishery-management-plan-and-amendments/.

Page, G.W., J.S. Warriner, J.C. Warriner, and P.W.C. Paton. 1995. Snowy plover (*Charadrius alexandrinus*). In *The Birds of North America*, No. 154 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA and The American Ornithologists' Union, Washington, D.C.

Parsons, L.S. and J. Zedler. 1997. Factors Affecting Reestablishment of an Endangered Annual Plant at a California Salt marsh. *Ecological Applications*. 7:253-267.

Pashley, D.N., C.J. Beardmore, J.A. Fitzgerald, R.P. Ford, W.C. Hunter, M.S. Morrison, K.V. Rosenberg. 2000. Partners in Flight: Conservation of the Land Birds of the United States. American Bird Conservancy, The Plains, VA.

Patton, R.T. 2002. California least tern breeding survey, 2000 Season. California Department of Fish and Game, Species Conservation and Recovery Program Report, 2002-03.

Pfeffer, W. T., J. T. Harper, and S. O'Neel. 2008. Kinematic Constraints on Glacier Contributions to 21st Century Sea-Level Rise. *Science* 5 September 2008: Vol. 321. No. 5894, pp. 1340 - 1343.

Phillips, G.H. 1980. Indians in Los Angeles. 1781-1875: Economic, Integration, Social Disintegration. *Pacific Historic Review* 59(3):427-451.

Powell, A. N. 1993. Nesting habitat of Belding's Savannah Sparrows in coastal salt marshes. Wetlands 13: 129-133.

Powell, A.N. and C.L. Collier. 1998. Reproductive success of Belding's savannah sparrows in a highly fragmented landscape. *Auk* 115(2): 508-513.

Raab, M. L., J.L. Porcasi, K. Bradford, and A. Yatsko. 1995. Beyond the 50-Precent Solution: Maritime Intensification at Eel Point, San Clemente, Island, California. Presented the Annual Meetings of the Society for California Archaeology, Eureka.

Rahmstorf, S. 2007. A Semi-Empirical Approach to Projecting Sea-Level Rise. Science v. 315, pp. 368-370.

Regional Water Quality Control Board (RWQCB) Santa Ana Region. 1995. 1995 Water Quality Control Plan (Basin Plan) for the Santa Ana River Basin. Updated in February 2008.

Regional Water Quality Control Board (RWQCB) Santa Ana Region. 1998. Regional Toxic Hot Spot Cleanup Plan.

Reid, H. 1939 (1852). Los Angeles County Indians. In Susanna B. Dakin, *A Scotch Paisano in Old Los Angeles*. University of California Press, Berkeley.

Reish, J.R., T.K.J. Kauwling and T. C. Schreiber. 1975. Annotated checklist of the marine invertebrates of Anaheim Bay. Pages 41 - 51 in E.D. Lane, C.W. Hill, eds., the Marine Resources of Anaheim Bay. California Department of Fish and Game, Fish Bulletin 165.

Robinson, W.W. 1979. *Land in California: The Story of Mission Lands, Ranchos, Squatters, Mining Claims, Railroad Grants, Land Scrip, and Homesteads*. University of California Press.

Sea Dyn, Inc. 1993. Anaheim Bay Wetlands Special Studies. Prepared for the Port of Long Beach.

Shipley, W. 1978. Native Languages of California. In *Handbook of North American Indians, California Vol. 8*, pp 80-90, R.F. Heizer, editor. Smithsonian Institution, Washington, D.C.

Shuford, W. D., and Gardali, T., editors. 2008. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

Sibley, D. A. 2000. *The Sibley Guide to Birds*. National Audubon Society.

Solomon, Susan, Karen Rosenlof, Robert Portmann, John Daniel, Sean Davis, Todd Sanford, and Gian-Kasper Plattner. 2010. Contributions of Stratospheric Water Vapor to Decadal Changes in the Rate of Global Warming (28 January 2010) *Science* [DOI: 10.1126/science.1182488].

Sonoran Joint Venture Technical Committee. Beardmore, C.J., ed. 2006. Sonoran Joint Venture: Bird Conservation Plan, Version 1.0. Tucson: Sonoran Joint Venture.

South Coast Air Quality Management District (SCAQMD). 2005. SCAQMD Rule Book. Rule 403, Fugitive Dust *(Adopted: May 7, 1976)(Amended: November 6, 1992, July 9, 1993, February 14, 1997,December 11, 1998, April 2, 2004, June 3, 2005)*. Available on-line at: http://www.arb.ca.gov/drdb/sc/cur.htm.

South Coast Air Quality Management District (SCAQMD). 2007. Final 2007 Air Quality Management Plan.

Southern California Association of Governments (SCAG). 2000. New Solutions for a New Economic Environmental. The Economy Chapter of the Regional Comprehensive Plan and Guide.

Southern California Association of Governments (SCAG). 2007. State of the Region 2007, Measuring Regional Progress. Part of the State of the Region 2007 Report.

Southern California Association of Governments (SCAG). 2008. Regional Pocket Guide 2008.

Southern California Association of Governments (SCAG). 2009. Climate Change and the Future of Southern California. Available on-line at: http://www.scag.ca.gov/publications/pdf/2009/ClimateChange/ClimateChange_Full_lores.pdf.

Southern California Coastal Water Research Project. 1998. Southern California Bight 1994 Pilot Project Executive Summary. January 1998. Westminster, CA. (http://www.sccwrp.org/regional/94scbpp/exesumry/94scbexesum.htm)

Southwest Fisheries Science Center. 2007. San Diego Bay Sea Turtle. Southwest Fisheries Science Center, NOAA Fisheries Service, Protected Resources Division Website. 4/2/2007. (http://swfsc.noaa.gov/textblock.aspx?Division=PRD&ParentMenuId=212&id=4378).

Stats Indiana. 2008a. Overview for Orange County, CA. USA Counties IN Profile. Accessed 2-22-08 on the World Wide Web at: http://www.stats.indiana.edu/uspr/a/us_profile_frame.html.

Stats Indiana. 2008b. BLS Covered Employment for Orange County, CA. USA Counties IN Profile. Accessed 2-22-08 on the World Wide Web at: http://www.stats.indiana.edu/uspr/a/us_profile_frame.html.

Stickel, G. E. 1991. A Baseline Archaeological Study for the City of Seal Beach, California. On file at South Central Coastal Information Center.

Stinson, M.L. 1984. Biology of sea turtles in San Diego Bay, California, and in northeastern Pacific Ocean. Master of Science thesis, San Diego State Univ., California.

Swickard, D. 1971. The status of the California least tern at Camp Pendleton, 1971. Rept. National Resources Office, Marine Corps Base, Camp Pendleton, Oceanside, California.

Talley, T.S., J.A. Crooks, and L.A. Levin. 2001. "Habitat Utilization and Alteration by the Invasive Burrowing Isopod, *Sphaeroma quoyanum*, in California Salt Marshes." Marine Biology (2001) 138:561-573.

Teggart, F. (ed.). 1911. The Portola Expedition of 1769-1770: Diary of Miguel Costanso. *Publications of the Academy of Pacific Coast History* 2(4).

Tierra Data Inc. 2008. Naval Weapons Station Seal Beach 2007 Herpetological Survey Report.

Underwood, J. and J. Cleland. 2002. Archaeological Testing at Sites P-30-001503, P-30-001503, and P-30-001504 Naval Weapons Station, Seal Beach, Orange County, California.

U.S. Army Corps of Engineers. 2001. Draft Integrated Cultural Resources Management Plan for the Naval Weapons Station, Seal Beach, Orange County, California 2001-2005. On file at Naval Weapons Station, Seal Beach, California.

U.S. Census Bureau. 2008. State and County QuickFacts: Orange County, California. Accessed 2-22-08 on the World Wide Web at: http://quickfacts.census.gov/qfd/states/06/06059.html

U.S. Department of Agriculture (USDA). 1978. Soil Survey of Orange County and Western Part of Riverside County, California. Soil Conservation Service and Forest Service in cooperation with University of California Agricultural Experiment Station.

U.S. Environmental Protection Agency (USEPA). 2007. Currently Designated Nonattainment Areas for All Criteria Pollutants. Accessed on February 4, 2008 at: http://www.epa.gov/oar/oaqps/greenbk/ancl.html#CALIFORNIA.

U.S. Fish and Wildlife Service (USFWS). 1985a. Revised California Least Tern Recovery Plan. USFWS, Portland, Oregon. September 27. Accessed on the World Wide Web at: http://ecos.fws.gov/docs/recovery_plan/850927.pdf .

U.S. Fish and Wildlife Service (USFWS). 1985b. Recovery Plan for the Light-footed Clapper Rail. Portland, Oregon.

U.S. Fish and Wildlife Service (USFWS). 1985c. Salt Marsh Bird's Beak (*Cordylanthus maritimus* subsp. *maritimus*) Recovery Plan.

U.S. Fish and Wildlife Service (USFWS). 1986. Executive Summary, Proposed Acquisition of Sweetwater River Wetlands Complex, San Diego County, California (November 1986).

U.S. Fish and Wildlife Service (USFWS). 1987. Management Plan Document Parts I & II for Seal Beach National Wildlife Refuge.

U.S. Fish and Wildlife Service (USFWS). 1993. Endangered and threatened wildlife and plants; determination of threatened status for the Pacific coast population of the western snowy plover; final rule. *Federal Register* 58(42):12864-12874.

U.S. Fish and Wildlife Service (USFWS). 1999. Environmental Assessment and Land Protection Plan, Proposed South San Diego Bay Unit and Stewardship Project San Diego National Wildlife Refuge.

U.S. Fish and Wildlife Service (USFWS). 2006a. San Diego Bay National Wildlife Refuge, Sweetwater Marsh and South San Diego Bay Units, *Final Comprehensive Conservation Plan and Environmental Impact Statement*. August.

U.S. Fish and Wildlife Service (USFWS). 2006b. California Least Tern (*Sternula antillarum browni*) 5-Year Review Summary and Evaluation. Carlsbad Fish and Wildlife Office, Carlsbad, CA.

U.S. Fish and Wildlife Service (USFWS). 2007. Recovery Plan for the Pacific Coast Population of Western Snowy Plover (*Charadrius alexandrinus nivosus*). California Nevada Operations Office, Sacramento, CA.

U.S. Fish and Wildlife Service (USFWS). 2010. Wetlands Mapper Documentation and Instructions Manual. U.S. Fish and Wildlife Service Division of Habitat and Resource Conservation Branch of Resource and Mapping Support National Standards and Support Team Madison, WI 53711-1061. August 2010.

U.S. Fish and Wildlife Service (USFWS). 2008. Birds of Conservation Concern 2008. Division of Migratory Bird Management, Arlington, Virginia.

U.S. Fish and Wildlife Service (USFWS) and U.S. Navy, Naval Weapons Station Seal Beach. 1991. Final Environmental Impact Statement for the Endangered Species Management and Protection Plan Naval Weapons Station Seal Beach and Seal Beach National Wildlife Refuge.

U.S. Navy. 1988. Master Plan Update 1988: Cultural Resources Assessment Final Report for Naval Weapons Station, Seal Beach.

U.S. Navy. 2007. Naval Weapons Station Seal Beach. Newsletter of the Environmental Investigation and Cleanup Program. October 2007.

U.S. Navy. 2011. Integrated Natural Resources Management Plan (Draft) – Naval Weapons Station Seal Beach. U.S. Department of the Navy, Naval Weapons Station Seal Beach, Environmental Department. Under Contract with Naval Facilities (NAVFAC) Southwest, Contract No. N68711-00-D-4413/0029.

U.S. Shorebird Conservation Plan. 2004. High Priority Shorebirds — 2004. Unpublished Report, U. S. Fish and Wildlife Service, 4401 N. Fairfax Dr., MBSP 4107, Arlington, VA, 22203 U.S.A.

Wallace, W. J. 1955. A Suggested Chronology for Southern California Coastal Archaeology. *Southwestern Journal of Anthropology* 11(3):214-230.

Warren, C. N. 1968. Cultural Tradition and Ecological Adaptation on the Southern California Coast. In Archaic Prehistory in the Western United States, edited by C. Irwin-Williams. *Eastern New Mexico Contributions in Anthropology* 1(3):1-14. Portales.

Warriner, J.S., J.C. Warriner, G.W. Page, and L.E. Stenzel. 1986. Mating system and reproductive success of a small population of polygamous snowy plovers. *Wilson Bulletin* 98(1):15-37.

White, R. C. 1963. *Luiseño Social Organization*. University of California Press, Berkeley.

Wilbur, S. R. 1974. The Status of the Light-footed Clapper Rail. American Birds. 28:868-870.

Wilson, B.D. 1952 (1852). *The Indians of Southern California in 1852: The B.D. Wilson Report and a Selection of Contemporary Comment*, edited by John W. Caughey. Huntington Library, San Marino, California.

Wlodarski, Robert J., John F. Romani, and Dan A. Larson. 1985. Archaeological Investigations at CA-ORA-1054, Orange County, California. *Pacific Coast Archaeological Society Quarterly* 21 (3) 1-24.

Zedler, J.B., J.C. Callaway, J.S. Desmond, F. Vivian-Smith, G.D. Williams, G. Sullivan, A.E. Brewster, and B.K. Bradshaw. 1999. "Californian Salt-Marsh Vegetation: An Improved Model of Spatial Pattern." Ecosystems 2:19-35.

Zembal, R.L. 1986. A survey of Belding's Savannah Sparrows on the Marine Corps Base, Camp Pendleton, California, 1984-1985. U.S. Fish and Wildlife Service, Laguna Niguel, California. [Available from the Carlsbad Fish and Wildlife Office, Carlsbad, California].

Zembal, R. 1989. Proposal and Permit Request for Light-footed Clapper Rail Translocations, Management, and Survey, 1999-2001.

Zembal, R.L. and S.M. Hoffman. 2002. A Survey of the Belding's Savannah Sparrow (*Passerculus sandwichensis beldingi*) in California, 2001. Species Conservation and Recovery Program Report No. 2002-01. Prepared under contract to the California Department of Fish and Game.

Zembal, R.L. and S.M. Hoffman. 2010. A Survey of the Belding's Savannah Sparrow (*Passerculus sandwichensis beldingi*) in California, 2010 (Draft). Species Conservation and Recovery Program Report No. 2010-xx. Prepared under contract to the California Department of Fish and Game.

Zembal, R.L., J. Konecny, and S.M. Hoffman. 2006. A Survey of the Belding's Savannah Sparrow (*Passerculus sandwichensis beldingi*) in California 2006. Species Conservation and Recovery Program Report No. 2006-03. Prepared under contract with the Clapper Rail Recovery Fund of the Huntington Beach Wetlands Conservancy for the California Department of Fish and Game. July 2006.

Zembal, R.L., K.J. Kramer, R.J. Bransfield, and N. Gilbert. 1988. A survey of Belding's savannah sparrows in California. *American Birds* 42(5): 1233-1236.

Zembal, R., S. Hoffman, and J. Konecny. 2007. Status and Distribution of The Light-footed Clapper Rail in California, 2007. Clapper Rail Recovery Fund, Huntington Beach, California. July 2007.

Zembal, R.L., S.M. Hoffman, C. Gailband, and L. Conrad. 2006. Light-footed Clapper Rail Management Study, and Translocation in California, 2005.

Zepeda-Herman, C. and J. Underwood. 2007. Seal Beach National Wildlife Refuge Cultural Resources Review for Comprehensive Conservation Planning, Seal Beach, California. Prepared for U.S. Department of the Interior, Fish and Wildlife Service, San Diego National Wildlife Refuge Complex, by RECON, San Diego, CA.

Appendices

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Appendix A

List of Preparers, Planning Team Members, and Persons/Agencies Consulted

List of Preparers, Planning Team Members, and Persons/Agencies Consulted

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Appendix B

Glossary of Terms

Glossary of Terms

1. Acronyms and Abbreviations

ACHP	Advisory Council on Historic Preservation
ACOE	United States Army Corps of Engineers
ADA	Americans with Disabilities Act
ADT	average daily traffic volumes
AHPA	Archaeological and Historic Preservation Act
Ai	active ingredient
APE	Area of Potential Effect
APHIS-PPQ	Animal and Plant Health Inspection Service, Plant Protection and Quarantine
AQMD	Air Quality Management District
AQMP	Air Quality Management Plan
ARB	California Air Resources Board
ARPA	Archaeological Resources Protection Act
ATV	all-terrain vehicle
Basin	South Coast Air Basin
BCC	Birds of Conservation Concern
BCRs	Bird Conservation Regions
BLM	Bureau of Land Management
BMPs	Best Management Practices
BOD	biological oxygen demand
CAAQS	California Ambient Air Quality Standards
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CCP	Comprehensive Conservation Plan
CDFG	California Department of Fish and Game
CDPH	California Department of Public Health
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CFWO	Carlsbad Fish and Wildlife Office
cm	centimeter
CNDDB	California Natural Diversity Database
CNEL	Community Noise Equivalent Level
CNPS	California Native Plant Society
CO	Carbon monoxide
Code	California Fish and Game Code
Complex	San Diego National Wildlife Refuge Complex
CRMP	Cultural Resources Management Program
CWA	California Waterfowl Association
dB	decibel
dBA	A-weighted noise scale

DDE	Dichloro-Diphenyl-Ethylene
DDT	Dichloro-diphenyl-trichloroethane
DMG	California Division of Mines and Geology
DOC	California Department of Conservation
DOI	Department of the Interior
EA	environmental assessment
EEC	estimated environmental concentration
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency (also USEPA)
ESA	Endangered Species Act of 1973 as amended
FEMA	Federal Emergency Management Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FMP	Fire Management Plan
FR	Federal Register
FTE	full-time equivalent
FY	Fiscal Year
GHGs	greenhouse gases
GIS	Geographic Information System
gpm	gallons per minute
HAPC	Habitat Areas of Particular Concern
HMP	Habitat Management Plan
HUD	U.S. Department of Housing and Urban Development
IBA	Important Bird Area
Improvement Act	National Wildlife Refuge System Improvement Act of 1997
INRMP	(Naval Weapons Station Seal Beach) Integrated Natural Resources Management Plan
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Pest Management
IR	Installation Restoration
kV	kilovolt
LCC	Landscape Conservation Cooperative
LCP	Local Coastal Program
Ldn	Day/Night Average Sound Level
LOC	Level of Concern
LOS	Level of Service
m^2	square meter
MBTA	Migratory Bird Treaty Act
mg/l	milligrams per liter
MHHW	mean higher high water
MHW	mean high water
MLLW	mean lower low water
mm/yr	millimeters per year
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MPAs	Marine Protected Areas
mph	miles per hour
MRP	Munitions Response Program
MSCP	Multiple Species Conservation Program
MSDS	Material Safety Data Sheet

MSL	mean sea level
Municipal Permit	Municipal Storm Water NPDES Permit
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NGDV	National Geodetic Vertical Datum
NGOs	non-governmental organizations
NHPA	National Historic Preservation Act
NIFZ	Newport-Inglewood Fault Zone
NMFS	National Marine Fisheries Service
NO_2	Nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOAEC	no observed concentration
NOEC	no observed effect concentration
NOI	Notice of Intent
NOx	Oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
NWRS	National Wildlife Refuge System
NWSSB	Naval Weapons Station Seal Beach
OCVCD	Orange County Vector Control District
O_3	Ozone
OEHHA	Office of Environmental Health Hazard Assessment
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PM_{10}	fugitive dust emissions or “inhalable particles” that are 10 microns (millionths of a meter) or less in diameter
$PM_{2.5}$	fine inhalable particles that are 2.5 microns and smaller
Port	Port of Long Beach
ppm	parts per million
ppt	parts per thousand
PUP	Pesticide Use Proposal
PUPS	Pesticide Use Proposal System
ROD	Record of Decision
RONS	Refuge Operating Needs System
RQ	risk quotients
RWQCB	Regional Water Quality Control Board
SAMMS	Service Asset Maintenance Management System
SCAQMD	South Coast Air Quality Management District
Service	U.S. Fish and Wildlife Service (also, USFWS)
SHC	Strategic Habitat Conservation
SJV	Sonoran Joint Venture
SHPO	State Historic Preservation Office
SO_4	Sulfates
SQO	sediment quality objective
SSC	California Species of Special Concern
State	California Department of Fish and Game
SUP	Special Use Permit
SWRCB	California State Water Resources Control Board

TBT	tributyltin
TMDL	total maximum daily load
TOT	transit occupancy taxes
TRPH	total recoverable petroleum hydrocarbons
USC	United States Code
USDA APHIS	U.S. Department of Agriculture, Animal Plant Health Inspection Service
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency (also EPA)
USFWS	U.S. Department of the Interior, Fish and Wildlife Service (also, Service)
USGS	United States Geological Survey
VOC	volatile organic compounds
WCB	Wildlife Conservation Board
WNV	West Nile Virus
WQA	water quality assessment
WQCP	Water Quality Control Plan
WSA	wilderness study area

2. Glossary of Terms

Abiotic. The non-living parts of an ecosystem (e.g. light, temperature, water, oxygen, and other nutrients or gases).

Accessibility. The state or quality of being easily approached or entered, particularly as it relates to complying with the Americans with Disabilities Act.

Accumulation. The build-up of a chemical in an organism due to repeated exposure.

Action Threshold. Mosquito population levels that trigger IPM actions to manipulate mosquito populations.

Adaptive Management. The rigorous application of management, research, and monitoring to gain information and experience necessary to assess and modify management activities. A process that uses feedback from refuge research and monitoring and evaluation of management actions to support or modify objectives and strategies at all planning levels. Analysis of results help managers determine whether current management should continue as is or whether it should be modified to achieve desired conditions.

Adulticide. Killing adult mosquitoes or a pesticide that kills adult mosquitoes.

Alluvial. Clay, silt, sand, gravel or other sedimentary matter transported and deposited in a delta or riverbed by flowing water.

Alternative. A reasonable way to resolve identified issues; a different set of objectives and strategies to achieve refuge goals and the desired future condition.

Aquatic. Pertaining to water, in contrast to land.

Arthropod-borne viruses (arboviruses). Viruses that are maintained in nature through biological transmission between susceptible vertebrate hosts by blood-feeding arthropods.
Artifact. An object used or made by humans, usually in reference to projectile points, tools, utensils, art, food remains, and other products of human activity.

Benthic. Refers to organisms associated with the bottom of the ocean, bay, lake, or river.

Biological Diversity. The variety of life and its processes, including the variety of living organisms, the genetic differences among them, and communities and ecosystems in which they occur. (See 601 FW 3 for more information on biological diversity.)

Biological Integrity. Biotic composition, structure, and functioning at the genetic, organism, and community levels consistent with natural conditions, including the natural biological processes that shape genomes, organisms, and communities.

Biota. The plant and animal life of a region.

Bivalve. Common term for pelecypods (members of Mollusca) in which the hard parts are composed of two sections fitting together to enclose a space that contains the soft part of the organism.

Categorical Exclusion. A category of actions that do not individually or cumulatively have a significant effect on the human environment and have been found to have no such effect in procedures adopted by a Federal agency pursuant to the National Environmental Policy Act.

Compatibility Determination. A written determination that a proposed or existing use of a National Wildlife Refuge is a compatible use or is not a compatible use.

Compatible Use. A proposed or existing wildlife-dependent recreational use or any other use of a National Wildlife Refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System Mission or the purposes of the Refuge on which the use would occur.

Comprehensive Conservation Plan (CCP). A document that describes the desired future conditions of the refuge or planning unit and provides long-range guidance and management direction to achieve the purposes of the refuge, helps fulfill the mission of the Refuge System; maintains and, where appropriate, restores the ecological integrity of each refuge and the Refuge System; helps achieve the goals of the National Wilderness Preservation System; and meets other mandates.

Critical Habitat. According to U.S. Federal law, the ecosystems upon which endangered and threatened species depend.

Cultural Resource Inventory. A professionally conducted study designed to locate and evaluate evidence of cultural resources present within a defined geographic area. Inventories may involve various levels, including background literature search, comprehensive field examination to identify all exposed physical manifestations of cultural resources, or sample inventory to project site distribution and density over a larger area. Evaluation of identified cultural resources to determine eligibility for the National Register follows the criteria found in 36 CFR 60.4.

Cultural Resource Overview. A comprehensive document prepared for a field office that discusses, among other things, its prehistory and cultural history, the nature and extent of known cultural resources, previous research, management objectives, resource management conflicts or issues, and a general statement on how program objectives should be met and conflicts resolved.

Cultural Resource. The physical remains of human activity (e.g., artifacts, ruins, historic sites, petroglyphs) and conceptual content or context of an area such as a traditional sacred site. It includes historically, archaeologically, and architecturally significant resources.

Detritus. An accumulation of decomposing plant and animal remains.

Dioxin. A family of toxic chemicals, including polychlorinated biphenyls (PCBs), that all share a similar chemical structure and a common mechanism of toxic action. Dioxin levels in the environment have been declining; however, current exposures levels still remain a concern.

Disturbance. Significant alteration of habitat structure or composition. May be natural (e.g., fire) or human-caused events (e.g., aircraft overflight). Also see wildlife disturbance.

Easement. A privilege or right that is held by one person or other entity in land owned by another.

Ecological Integrity. The integration of biological integrity, natural biological diversity, and environmental health; the replication of natural conditions.

Ecoregion. A territory defined by a combination of biological, social, and geographic criteria, rather than geopolitical considerations; generally, a system of related, interconnected ecosystems.

Ecosystem Approach. Protecting or restoring the natural function (processes), structure (physical and biological patterns), and species composition of an ecosystem, recognizing that all components are interrelated.

Ecosystem Management. Management of an ecosystem that includes all ecological, social and economic components that makes up the whole of the system.

Ecosystem. A dynamic and interrelated complex of plant and animal communities and their associated non-living environment.

Effect. A change in a resource, caused by a variety of events including project attributes acting on a resource attribute (direct), not directly acting on a resource attribute (indirect), another project attributes acting on a resource attribute (cumulative), and those caused by natural events (e.g., seasonal change).

Endangered Species (Federal). A plant or animal species listed under the Endangered Species Act that is in danger of extinction throughout all or a significant portion of its range.

Endangered Species (State). A plant or animal species in danger of becoming extinct or extirpated in California within the near future if factors contributing to its decline continue.

Environment. The sum total of all biological, chemical, and physical factors to which organisms are exposed; the surroundings of a plant or animal.

Environmental Assessment (EA). A concise public document, prepared in compliance with the National Environmental Policy Act, that briefly discusses the purpose and need for an action, alternatives to such action, and provides sufficient evidence and analysis of impacts to determine whether to prepare an Environmental Impact Statement or Finding of No Significant Impact.

Environmental Education. A process designed to develop a citizenry that has the awareness, concern, knowledge, attitudes, skills, motivation, and commitment to work toward solutions of current environmental problems and the prevention of new ones. Environmental education within the National Wildlife Refuge System incorporates materials, activities, programs, and products that address the citizen's course of study goals, the objectives of the refuge or unit, and the mission of the Refuge System.

Environmental Health. Composition, structure, and functioning of soil, water, air, and other abiotic features comparable with historic conditions, including the natural abiotic processes that shape the environment. (See 601 FW 3.)

Environmental Impact Statement (EIS). A detailed written statement required by Section 102(2)(C) of the National Environmental Policy Act, analyzing the environmental impacts of a proposed action, adverse effects of the project that cannot be avoided, alternative courses of action, short-term uses of the environment versus the maintenance and enhancement of long-term productivity, and any irreversible and irretrievable commitment of resources (40 CFR 1508.11).

Epibenthic. Pertaining to the environment and conditions of organisms living near the water bottom.

Estuarine. Deepwater tidal habitats and adjacent tidal wetlands that are usually partly enclosed by land but have some access to the open ocean and are diluted by freshwater.

Estuary. The wide lower course of a river into which the tides flow. The area where the tide meets a river current.

Euryhaline. Organisms that are tolerant of a wide range of salinity.

Exotic Species. Species that have been intentionally introduced to or have inadvertently infiltrated an area in which they are not natural found. Exotic species compete with native species for food or habitat.

Fallow. Allowing land that normally is used for crop production to lie idle.

Federal Trust Resources. A trust is something managed by one entity for another who holds the ownership. The Service holds in trust many natural resources for the people of the United States of America as a result of Federal acts and treaties. Examples are species listed under the Endangered Species Act, migratory birds protected by the Migratory Bird Treaty Act and other international treaties, and native plant or wildlife species found on the Refuge System.

Finding of No Significant Impact (FONSI). A document prepared in compliance with the National Environmental Policy Act, supported by an environmental assessment, that briefly presents why a Federal action will have no significant effect on the human environment and for which an environmental impact statement, therefore, will not be prepared (40 CFR 1508.13).

Fiscal Year. Federal Government budget year beginning October 1 and ending September 31.

Floodplain. The relatively flat area along the sides of a river which is naturally subjected to flooding.

Flyway. A route taken by migratory birds between their breeding grounds and their wintering grounds. Four primary migration routes have been identified for birds breeding in North America: the Pacific, Central, Mississippi, and Atlantic Flyways.

Foraging. The act of feeding; another word for feeding.

Forb. A broad-leaved, herbaceous plant.

Fragmentation. The process of reducing the size and connectivity of habitat patches.

Gastropod. Any of a large class of mollusks, usually with a univalve shell or no shell and a distinct head bearing sensory organs, such as snails and slugs.

Goal. Descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units.

Habitat Restoration. Management emphasis designed to move ecosystems to desired conditions and processes, and/or to healthy ecosystems.

Habitat Type. See Vegetation Type.

Habitat. Suite of existing environmental conditions required by an organism for survival and reproduction. The place where an organism typically lives.

Health Threat. An adverse impact to the health of human or wildlife populations from mosquitoes identified and documented by Federal, State, and/or local public health authorities.

Hydrologic Regime. The local pattern and magnitude of water flow influenced by season.

Hydrology. The science dealing with the properties, distribution, and circulation of water on and below the earth's surface and in the atmosphere. The distribution and cycling of water in an area.

Impact. Refer to Effect.

Integrated Pest Management (IPM). A sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks.

Interpretation. Interpretation can be an educational and recreational activity that is aimed at revealing relationships, examining systems, and exploring how the natural world and human activities are interconnected.

Intertidal Mudflat. Expanses of mud contiguous to a water body often covered and exposed by tides.

Invasive Species. Refer to Exotic Species.

Inversion. A state in which the temperature of the air increases with increasing altitude and keeps the surface air and pollutants down.

Invertebrate. Animals that do not have backbones. Included are insects, spiders, mollusks (clams, snails, etc.), and crustaceans (shrimp, crayfish, etc.).

Issue. Any unsettled matter that requires a management decision (e.g., a Service initiative, opportunity, resource management problem, a threat to the resources of the unit, conflict in uses, public concern, or the presence of an undesirable resource condition).

Landbird. A category of birds that obtains at least part of their food from the land and nest in mainland areas (though some can also be found on islands). Landbirds include raptors and songbirds among others.

Landform. The physical shape of the land reflecting geologic structure and processes of geomorphology that have sculpted the structure.

Landowner: A person or entity indicated as the owner of property on the various ownership maps maintained by the Office of the County Assessor.

Larvicide. Killing mosquito larvae, or a pesticide that kills mosquito larvae.

Lease. A legal contract by which rights to use land or water are acquired for a specified period of time for a specified rent or compensation.

Macroinvertebrates. Invertebrates large enough to be seen with the naked eye (e.g., most aquatic insects, snails, and amphipods).

Management Alternative. A set of objectives and the strategies needed to accomplish each objective [FWS Manual 602 FW 1.4].

Management Concern. Refer to Issue.

Marsh Habitat. Habitat that is characterized by shallow water and emergent vegetation; unless otherwise specified, this term does not apply to similar habitat found in rivers, drains, or canals.

Marsh. A periodically wet or continually flooded area where water is shallow enough to allow the growth of emergent vegetation; a marsh can be influenced by freshwater, tides, or both.

Migration. The seasonal movement from one area to another and back.

Migratory Bird. A bird that seasonally moves between geographic areas.

Mitigation. To avoid or minimize impacts of an action by limiting the degree or magnitude of the action; to rectify the impact by repairing, rehabilitating, or restoring the affected environment; to reduce or eliminate the impact by preservation and maintenance operations during the life of the action.

Model. A mathematical formula that expresses the actions and interactions of the elements of a system in such a manner that the system may be evaluated under any given set of conditions.

Monitoring. The process of collecting information to track changes of selected parameters over time. Monitoring is necessary to identify, track and analyze results of management actions at the Refuge so that future management actions may be adapted to obtain the best benefits to wildlife and habitat. See also Adaptive Management.

Mosquito Management. Any activity designed to inhibit or reduce populations of flies in the family

Mosquito Population Monitoring. Activities associated with collecting quantitative data to determine mosquito species composition and to estimate relative changes in mosquito population sizes over time.

Mosquito-Borne Disease Surveillance. Activities associated with detecting pathogens causing mosquito-borne diseases, such as testing adult mosquitoes for pathogens or testing reservoir hosts for pathogens or antibodies.

Mosquito-Borne Disease. An illness produced by a pathogen that mosquitoes transmit to humans and other vertebrates. The major mosquito-borne pathogens presently known to occur in the United States that are capable of producing human illness are the viruses causing eastern equine encephalitis, western equine encephalitis, St. Louis encephalitis, West Nile encephalitis/fever, LaCrosse encephalitis, and dengue, as well as the protozoans causing malaria.

National Environmental Policy Act (NEPA). An act which encourages productive and enjoyable harmony between humans and their environment, to promote efforts that will prevent or eliminate damage to the environment and atmosphere, to stimulate the health and welfare of humans. The act also established the Council on Environmental Quality. The Act requires all agencies, including the Service, to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in the planning and implementation of all actions. Federal agencies must integrate NEPA with other planning requirements, and prepare appropriate NEPA documents to facilitate better environmental decision making.

National Wildlife Refuge (Refuge or NWR). A designated area of land or water or an interest in land or water within the Refuge System, including National Wildlife Refuges, Wildlife Ranges, Wildlife Management Areas, Waterfowl Production Areas, and other areas (except Coordination Areas) under Service jurisdiction for the protection and conservation of fish and wildlife.

National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57). Under the Refuge Improvement Act, the Service is required to develop 15-year Comprehensive Conservation Plans for all National Wildlife Refuges outside Alaska. The Act also describes the six public uses given priority status within the NWRS (i.e., hunting, fishing, wildlife observation, photography, environmental education, and interpretation).

National Wildlife Refuge System Mission. "The mission of the 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."

National Wildlife Refuge System. Various categories of areas administered by the Secretary of the Interior for the conservation of fish and wildlife, including species threatened with extinction; all lands, waters, and interests therein administered by the Secretary as wildlife refuges; areas for the protection and conservation of fish and wildlife that are threatened with extinction; wildlife ranges; games ranges; wildlife management areas; or waterfowl production areas.

Native Species. Species that normally live and thrive in a particular ecosystem.

Natural Recruitment. Plant establishment through natural processes.

Neotropical Migratory Birds. Migratory birds that breed in North American and winter in Central and South America.

No Action Alternative. An alternative under which existing management would be continued.

Non-target Organisms. Species or communities other than those designated for population control.

Notice of Intent (NOI). A notice that is published in the Federal Register announcing that an Environmental Impact Statement will be prepared and considered for a specific action.

Objective. An objective is a concise target statement of what will be achieved, how much will be achieved, when and where it will be achieved, and who is responsible for the work. Objectives are derived from goals and provide the basis for determining management strategies. Objectives should be attainable and time-specific and should be stated quantitatively to the extent possible. If objectives cannot be stated quantitatively, they may be stated qualitatively.

Opportunities. Potential solutions to issues.

Ordinary High Water Mark. That line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.

Outreach. Two-way communication between the Service and the public to establish mutual understanding, promote involvement, and influence attitudes and actions, with goal of improving joint stewardship of our natural resources.

Passerine Bird. A songbird or other perching bird that is in the order Passeriformes (blackbirds, crows, warblers, sparrows, and wrens for example).

Perennial. In reference to a body of water, one that contains water year-to-year and that rarely goes dry.

Permeability. The property or capacity of porous rock, sediment, or soil to transmit water.

Phenology. The life cycle of particular species.

Planning Team. A team or group of persons working together to prepare a document. Planning teams are interdisciplinary in membership and function and generally consist of a planning team leader, refuge manager and staff biologists, a state natural resource agency representative, and other appropriate program specialists (e.g., social scientist, ecologist, recreation specialist).

Planning Unit or Unit. A single refuge, an ecologically or administratively related refuge complex, or distinct unit of a refuge. The planning unit also may include lands currently outside refuge boundaries.

Plant Association. A classification of plant communities based on the similarity in dominants of all layers of vascular species in a climax community.

Plant Community. An assemblage of plant species of a particular composition. The term can also be used in reference to a group of one or more populations of plants in a particular area at a particular point in time; the plant community of an area can change over time due to disturbance (e.g., fire) and succession.

Pollutant or Contaminant. Any introduced gas, liquid, or solid that makes a resource unfit for a specific purpose.

Polychaetes. Any of a class (Polychaeta) of chiefly marine annelid worms (such as clam worms), usually with paired segmental appendages, separate sexes, and a free-swimming trochophore larva.

Polychlorinated Biphenyls (PCBs). A mixture of individual chemicals which are no longer produced in the United States, but are still found in the environment.

Polycyclic Aromatic Hydrocarbons (PAHs). A group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot.

Population. All the members of a single species coexisting in one ecosystem at a given time.

Preferred Alternative. This is the alternative determined by the decision maker to best achieve the Refuge purpose, vision, and goals; contributes to the Refuge System mission, addresses the significant issues; and is consistent with principles of sound fish and wildlife management.

Prime Farmland. Farmland in an area or region that is considered to be the most ideal farmland based on several criteria; usually soil types and land productivity of the land are two of the most important criteria.

Priority Public Uses. Compatible wildlife-dependent recreation uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation).

Proposed Action. The management alternative that the Planning Team feels could best achieve Refuge purposes, vision, and goals while helping to fulfill the Refuge System mission.

Public Health Authority. A Federal, State, and/or local agency that has health experts with training and expertise in mosquitoes and mosquito-borne diseases and that has the official capacity to identify health threats and determine when there is a high risk for serious human disease or death from mosquitoes.

Public Health Emergency. An imminent risk of serious human disease or death, or an imminent risk to populations of wildlife or domestic animals. A health emergency represents the highest level of mosquito-associated health threats, as documented and determined by Federal, State, and/or local public health authorities.

Public Involvement. A process that offers impacted and interested individuals and organizations an opportunity to become informed about, and to express their opinions on Service actions and policies. In the process, these views are studied thoroughly and thoughtful consideration of public views is given in shaping decisions for refuge management.

Public Scoping: See Public Involvement.

Public. Individuals, organizations, and groups; officials of Federal, State, and local government agencies; Indian tribes; and foreign nations. It may include anyone outside the core planning team. It includes those who may or may not have indicated an interest in Service issues and those who do or do not realize that Service decisions may affect them.

Pupacide. A pesticide that kills the pupal stage of mosquitoes.

Purpose(s) of the Refuge. The purpose of a refuge is specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorization, or expanding a refuge, refuge unit, or refuge subunit.

Raptor. A category of carnivorous birds, most of which have heavy, sharp beaks, strong talons, and take live prey (e.g., peregrine falcon, northern harrier). Also referred to as a bird of prey.

Record of Decision (ROD). A concise public record of decision prepared by the Federal agency, pursuant to NEPA, that contains a statement of the decision, identification of all alternatives considered, identification of the environmentally preferable alternative, a statement as to whether all practical means to avoid or minimize environmental harm from the alternative selected have been adopted (and if not, why they were not), and a summary of monitoring and enforcement where applicable for any mitigation.

Recruitment. The annual increase in a population as determined by the proportion of surviving offspring produced during a specific period (usually expressed per year).

Refuge Goal. Refer to Goal.

Refuge Operating Needs System (RONS). A national database that contains the unfunded operational needs of each refuge. The Service includes projects required to implement approved plans and meet goals, objectives, and legal mandates.

Refuge Purposes. Refer to Purposes of a Refuge.

Refuge Revenue Sharing Program. Provides payments to counties in lieu of taxes using revenues derived from the sale of products from refuges.

Refuge Use. Any activity on a refuge, except administrative or law enforcement activity carried out by or under the direction of an authorized service employee.

Refuge Vision. A succinct statement of the unit's purpose and reason for being.

Restoration. The return of an ecosystem to an approximation of its former unimpaired condition.

Revetment. A facing of stone, concrete, or other material placed on a riverbank to protect it from erosion.

Rhizomes. Rootlike stem growing horizontally below the surface. The rhizome is used for food storage and can produce roots and shoots.

Scoping. A process for determining the range of issues to be addressed by a Comprehensive Conservation Plan and for identifying the significant issues that involves input from a range of government agencies, including Tribes, as well as private organizations, landowners, other interested parties, and the public.

Seabird. A group of birds that obtain at least some food from the ocean by traveling some distance over its surface. They also typically breed on islands and along coastal areas. Seabirds include gulls, terns, pelicans, and cormorants, among others.

Sediment. Any material, carried in suspension by water, which ultimately settles to the bottom of water courses. Sediments may also settle on stream banks or flood plains during high water flow.

Shorebirds. Long-legged birds, also known as waders, belonging to the order Charadriiformes, which use shallow wetlands and mud flats for foraging and nesting.

Soil Erosion. The wearing away of the land's surface by water, wind, ice, or other physical process.

Songbirds. A category of birds that are medium to small, perching landbirds. Most are territorial singers and migratory. (Refer also to Passerines.)

Sound Professional Judgment. A finding, determination, or decision that is consistent with principles of sound fish and wildlife management and administration, available science and resources, and adherence to the requirements of the Refuge Administration Act of 1966 (16 U.S.C. 668dd-668ee), and other applicable laws. Included in the finding, determination, or decision is a refuge manager's field experience and knowledge of the particular refuge's resources.

Southern California Bight. A curve in the southwestern California coastline that extends for Point Conception to just south of the Mexican border; the marine ecosystem and overall biodiversity in this area are influenced by the dramatic change in the angle of the coastline, which creates a significant backwater eddy. This backwater eddy results in the northern flow of equatorial waters along the nearshore and the southern flow of subarctic waters offshore, creating a biological transition zone between the warm and cold waters that supports approximately 500 marine fish species and more than 5,000 invertebrate species (*Southern California Coastal Water Research Project 1998*).

Species Composition. A group of species that inhabit a specific habitat type in its healthy state.

Species Diversity. Usually synonymous with "species richness," but may also include the proportional distribution of species.

Species. A distinctive kind of plant or animal having distinguishable characteristics, and that can interbreed and produce young. A category of biological classification.

Step-down Management Plan. A plan that provides specific guidance on management subjects (e.g., habitat, public use, fire, safety) or groups of related subjects. It describes strategies and implementation schedules for meeting CCP goals and objectives.

Strategy. A specific action, tool, or technique or combination of actions, tools, and techniques used to meet unit objectives.

Study Area. The area reviewed in detail for wildlife, habitat, and public use potential. For purposes of this CCP/EIS the study area includes the land and water within the approved Refuge boundary.

Sublittoral. Relating to or describing an organism living immediately below low-tide level.

Submergent Vegetation. Plants that grows completely submerged except when flowering.

Subsidence. Movement to a lower level or elevation.
Surface Water. A body of water that has its upper surface exposed to the atmosphere.

Threatened Species (Federal). A plant or animal species identified and defined in accordance with the 1973 Endangered Species Act and published in the Federal Register, as likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Tiering. The coverage of general matters in broader environmental impact statements with subsequent narrower statements of environmental analysis, incorporating by reference, the general discussions and concentrating on specific issues.

Trace Elements. Metallic elements generally occurring in trace amounts in water, including iron, manganese, copper, chromium, arsenic, mercury, and vanadium.

Turbidity. Cloudiness of a water body caused by suspended silt, mud, pollutants, or algae.

U.S. Fish and Wildlife Service Mission. "Working with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.

Understory. Shrubs and herbaceous plants that typically grow beneath larger trees or shrubs.

Upland. An area where water normally does not collect and where water does not flow on an extended basis. Uplands are non-wetland areas.

Vector. An organism, such as an insect or tick, that is capable of acquiring and transmitting a disease-causing agent, or pathogen, from one vertebrate host to another, or the act of transmitting a pathogen in such a manner.

Vegetation Community. Refer to Plant Community.

Vegetation Type or Habitat Type. A land classification system based upon the concept of distinct plant associations.

Vegetation. The composition of plant species, their frequency of occurrence, density, and age classes at a specified scale.

Waterfowl. A group of birds that include ducks, geese, and swans (belonging to the order Anseriformes).

Watershed. The entire land area that collects and drains water into a river or river system.

Wetland. Areas such as lakes, marshes, and streams that are inundated by surface or ground water for a long enough period of time each year to support, and that do support under natural conditions, plants and animals that require saturated or seasonally saturated soils.

Wildfire or Wildland Fire. A free-burning fire requiring a suppression response; all fire other than prescribed fire that occurs on wildlands.

Wildlife. All non-domesticated animal life; included are vertebrates and invertebrates.

Wildlife-Dependent Recreational Use. "A use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation." These are the six priority public uses of the Refuge System as established in the National Wildlife Refuge System Administration Act, as amended.

Appendix C

Species Lists

Appendix C: Species Lists

Bird Species List

The following list includes bird species that have been observed within the Seal Beach NWR and the adjacent Naval Weapons Station Seal Beach. The birds' common and scientific names are provided in accordance with the 7th edition (1998), tenth Supplement (2010) of the A. O. U. Checklist of North American Birds. (* Indicates bird species known or have the potential to nest on the refuge, † indicates bird species that nest in proximity to the Refuge, and # indicates birds observed on the adjacent Naval Weapons Station Seal Beach that although not yet observed, may also occasionally occur on the Refuge.)

Common Name	**Scientific Name**
Red-throated Loon	*Gavia stellata*
Pacific Loon	*Gavia pacifica*
Common Loon	*Gavia immer*
Pied-billed Grebe	*Podilymbus podiceps*
Horned Grebe	*Podiceps auritus*
Red-necked Grebe	*Podiceps grisegena*
Eared Grebe	*Podiceps nigricollis*
Western Grebe	*Aechmophorus occidentalis*
Clark's Grebe	*Aechmophorus clarkia*
American White Pelican	*Pelecanus erythrorhynchos*
California Brown Pelican	*Pelecanus occidentalis californicus*
Brandt's Cormorant#	*Phalacrocorax penicillatus*
Double-crested Cormorant	*Phalacrocorax auritus*
Pelagic Cormorant#	*Phalacrocorax pelagicus*
American Bittern	*Botaurus lentiginosus*
Great Blue Heron*	*Ardea herodias*
Great Egret	*Ardea alba*
Snowy Egret	*Egretta thula*
Little Blue Heron	*Egretta caerulea*
Tricolored Heron	*Egretta tricolor*
Reddish Egret	*Egretta rufescens*
Green Heron	*Butorides virescens*
Cattle Egret	*Bubulcus ibis*
Black-crowned Night Heron	*Nycticorax nycticorax*
White-faced Ibis	*Plegadis chihi*
Turkey Vulture	*Cathartes aura*
Greater White-fronted Goose	*Anser albifrons*
Snow Goose	*Chen caerulescens*
Ross's Goose	*Chen rossii*
Canada Goose	*Branta canadensis*
Brant	*Branta bernicla*

Bird Species List (continued)

Common Name	Scientific Name
Cackling Goose	*Branta hutchinsii*
Mute Swan	*Cygnus olor*
Tundra Swan	*Cygnus columbianus*
Gadwall*	*Anas strepera*
Eurasian Wigeon	*Anas penelope*
American Wigeon	*Anas americana*
Mallard*	*Anas platyrhynchos*
Blue-winged Teal	*Anas discors*
Cinnamon Teal	*Anas cyanoptera*
Northern Shoveler	*Anas clypeata*
Northern Pintail	*Anas acute*
Green-winged Teal	*Anas crecca*
Canvasback	*Aythya valisineria*
Redhead	*Aythya americana*
Ring-necked Duck	*Aythya collaris*
Greater Scaup	*Aythya marila*
Lesser Scaup	*Aythya affinis*
Surf Scoter	*Melanitta perspicillata*
Long-tailed Duck	*Clangula hyemalis*
Bufflehead	*Bucephala albeola*
Common Goldeneye	*Bucephala clangula*
Hooded Merganser	*Lophodytes cucullatus*
Common Merganser	*Mergus merganser*
Red-breasted Merganser	*Mergus serrator*
Ruddy Duck	*Oxyura jamaicensis*
Osprey	*Pandion haliaetus*
White-tailed Kite	*Elanus leucurus*
Bald Eagle	*Haliaeetus leucocephalus*
Northern Harrier	*Circus cyaneus*
Sharp-shinned Hawk	*Accipiter striatus*
Cooper's Hawk	*Accipiter cooperii*
Red-shouldered Hawk	*Buteo lineatus*
Swainson's Hawk#	*Buteo swainsoni*
Red-tailed Hawk*	*Buteo jamaicensis*
Ferruginous Hawk	*Buteo regalis*
Golden Eagle	*Aquila chrysaetos*
American Kestrel*	*Falco sparverius*
Merlin	*Falco columbarius*
Peregrine Falcon	*Falco peregrinus*
Prairie Falcon	*Falco mexicanus*
Light-footed Clapper Rail*	*Rallus longirostris levipes*
Virginia Rail	*Rallus limicola*
Sora	*Porzana Carolina*

Bird Species List (continued)

Common Name	Scientific Name
American Coot	*Fulica americana*
Black-bellied Plover	*Pluvialis squatarola*
Pacific-golden Plover	*Pluvialis fulva*
Western Snowy Plover	*Charadrius alexandrinus nivosus*
Semipalmated Plover	*Charadrius semipalmatus*
Killdeer*	*Charadrius vociferous*
Mountain Plover#	*Charadrius montanus*
Black Oystercatcher#	*Haematopus bachmani*
Black-necked Stilt*	*Himantopus mexicanus*
American Avocet*	*Recurvirostra americana*
Spotted Sandpiper	*Actitis macularius*
Wandering Tattler#	*Tringa incana*
Greater Yellowlegs	*Tringa melanoleuca*
Willet	*Tringa semipalmatus*
Lesser Yellowlegs	*Tringa flavipes*
Whimbrel	*Numenius phaeopus*
Long-billed Curlew	*Numenius americanus*
Marbled Godwit	*Limosa fedoa*
Ruddy Turnstone	*Arenaria interpres*
Black Turnstone	*Arenaria melanocephala*
Surfbird	*Aphriza virgata*
Red Knot	Calidris canutus
Sanderling	*Calidris alba*
Western Sandpiper	*Calidris mauri*
Least Sandpiper	*Calidris minutilla*
Baird's Sandpiper	*Calidris bairdii*
Pectoral Sandpiper	*Calidris melanotos*
Dunlin	*Calidris alpine*
Stilt Sandpiper	*Calidris himantopus*
Ruff	*Philomachus pugnax*
Short-billed Dowitcher	*Limnodromus griseus*
Long-billed Dowitcher	*Limnodromus scolopaceus*
Common Snipe	*Gallinago gallinago*
Wilson's Phalarope	*Phalaropus tricolor*
Red-necked Phalarope	*Phalaropus lobatus*
Red Phalarope	*Phalaropus fulicarius*
Bonaparte's Gull	*Chroicocephalus philadelphia*
Heermann's Gull	*Larus heermanni*
Ring-billed Gull	*Larus delawarensis*
California Gull	*Larus californicus*
Herring Gull	*Larus argentatus*
Western Gull	*Larus occidentalis*
Glaucous-winged Gull	*Larus glaucescens*

Bird Species List (continued)

Common Name	Scientific Name
Glaucous Gull	*Larus hyperboreus*
Black Skimmer*	*Rynchops niger*
California Least Tern*	*Sternula antillarum browni*
Gull-billed Tern	*Gelochelidon nilotica*
Caspian Tern	*Hydroprogne caspia*
Black Tern	*Chlidonias niger*
Common Tern	*Sterna hirundo*
Forster's Tern*	*Sterna forsteri*
Royal Tern	*Thalasseus maximus*
Elegant Tern	*Thalasseus elegans*
Rock Dove	*Columba livia*
Spotted Dove	*Streptopelia chinensis*
Mourning Dove*	*Zenaida macroura*
Common Ground-Dove#	*Columbina passerina*
Barn Owl*	*Tyto alba*
Great Horned Owl	*Bubo virginianus*
Burrowing Owl*	*Athene cunicularia*
Short-eared Owl	*Asio flammeus*
Lesser Nighthawk	*Chordeiles acutipennis*
White-throated Swift	*Aeronautes saxatalis*
Black-chinned Hummingbird#	*Archilochus alexandri*
Anna's Hummingbird*	*Calypte anna*
Costa's Hummingbird#	*Calypte costae*
Rufous Hummingbird#	*Selasphoras rufus*
Allen's Hummingbird	*Selasphorus sasin*
Belted Kingfisher	*Megaceryle alcyon*
Red-breasted Sapsucker#	*Sphyrapicus ruber*
Downy Woodpecker#	*Picoides pubescens*
Northern Flicker	*Colaptes auratus*
Western Wood-Pewee	*Contopus sordidulus*
Hammond's Flycatcher	*Empidonax hammondii*
Pacific-slope Flycatcher	*Empidonax difficilis*
Black Phoebe	*Sayornis nigricans*
Say's Phoebe	*Sayornis saya*
Ash-throated Flycatcher	*Myiarchus cinerascens*
Cassin's Kingbird	*Tyrannus vociferans*
Western Kingbird*	*Tyrannus verticalis*
Loggerhead Shrike*	*Lanius ludovicianus*
Warbling Vireo	*Vireo gilvus*
Western Scrub Jay#	*Aphelocoma californica*
American Crow	*Corvus brachyrhynchos*
Common Raven*	*Corvus corax*
Horned Lark*	*Eremophila alpestris*

Bird Species List (continued)

Common Name	Scientific Name
Tree Swallow	*Tachycineta bicolor*
Violet-green Swallow	*Tachycineta thalassina*
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Cliff Swallow†	*Petrochelidon pyrrhonota*
Barn Swallow†	*Hirundo rustica*
Bushtit*	*Psaltriparus minimus*
Rock Wren	*Salpinctes obsoletus*
Bewick's Wren#	*Thryomanes bewickii*
House Wren	*Troglodytes aedon*
Marsh Wren	*Cistothorus palustris*
Ruby-crowned Kinglet	*Regulus calendula*
Blue-gray Gnatcatcher	*Polioptila caerulea*
Western Bluebird	*Sialia mexicana*
Mountain Bluebird	*Sialia currucoides*
Hermit Thrush	*Catharus guttatus*
American Robin#	*Turdus migratorius*
Northern Mockingbird*	*Mimus polyglottos*
Sage Thrasher	*Oreoscoptes montanus*
European Starling*	*Sturnus vulgaris*
American Pipit	*Anthus rubescens*
Cedar Waxwing#	*Bombycilla cedrorum*
Orange-crowned Warbler	*Oreothlypis celata*
Nashville Warbler	*Oreothlypis ruficapilla*
Yellow Warbler	*Dendroica petechia*
Yellow-rumped Warbler	*Dendroica coronata*
Black-throated Gray Warbler	*Dendroica nigrescens*
Townsend's Warbler	*Dendroica townsendi*
Hermit Warbler	*Dendroica occidentalis*
Common Yellowthroat*	*Geothlypis trichas*
Wilson's Warbler	*Wilsonia pusilla*
Western Tanager	*Piranga ludoviciana*
Green-tailed Towhee	*Pipilo chlorurus*
Spotted Towhee	*Pipilo maculatus*
California Towhee#	*Melozone crissalis*
Chipping Sparrow	*Spizella passerina*
Lark Sparrow	*Chondestes grammacus*
Savannah Sparrow	*Passerculus sandwichensis*
Belding's Savannah Sparrow*	*Passerculus sandwichensis beldingi*
Large-billed Savannah Sparrow	*Passerculus sandwichensis rostratus*
Nelson's Sparrow	*Ammodramus nelsoni*
Fox Sparrow	*Passerella iliaca*
Song Sparrow*	*Melospiza melodia*
Lincoln's Sparrow	*Melospiza lincolnii*

Bird Species List (continued)

Common Name	Scientific Name
White-crowned Sparrow	*Zonotrichia leucophrys*
Golden-crowned Sparrow	*Zonotrichia atricapilla*
Lapland Longspur#	*Calcarius lapponicus*
Black-headed Grosbeak	*Pheucticus melanocephalus*
Blue Grosbeak	*Passerina caerulea*
Lazuli Bunting#	*Passerina amoena*
Red-winged Blackbird*	*Agelaius phoeniceus*
Tricolored Blackbird#	*Agelaius tricolor*
Western Meadowlark*	*Sturnella neglecta*
Yellow-headed Blackbird#	*Xanthocephalus xanthocephalus*
Brewer's Blackbird#	*Euphagus cyanocephalus*
Brown-headed Cowbird	*Molothrus ater*
Hooded Oriole*	*Icterus cucullatus*
Bullock's Oriole	*Icterus bullockii*
House Finch*	*Carpodacus mexicanus*
Lesser Goldfinch	*Spinus psaltria*
American Goldfinch	*Spinus tristis*
House Sparrow*	*Passerculus domesticus*

Salt Marsh Native Plant Species List

The plant species listed below are the more predominant plant species occurring within the salt marsh complex at the Seal Beach NWR.

Common Name	Scientific Name
Jaumea	*Jaumea carnosa*
Saltwort	*Batis maritima*
Annual pickleweed	*Salicornia bigelovii*
Glasswort	*Salicornia subterminalis*
Common Pickleweed	*Sarcocornia pacifica*
Sea-blite	*Suaeda esteroa*
Alkali weed	*Cressa truxillensis*
Alkali heath	*Frankenia salina*
Boxthorn	*Lycium californicum*
Sea-lavender	*Limonium californicum*
Arrow-grass	*Triglochin concinna*
Saltgrass	*Distichlis spicata*
Shoregrass	*Monanthochloe littoralis*
Cordgrass	*Spartina foliosa*

Terrestrial Invertebrates

Limited information is available regarding the terrestrial invertebrates present on the Refuge. The invertebrate species listed below are identified as focus management species for all of Naval Weapons Station Seal Beach, including the Refuge, in the IRNMP (*U.S. Navy 2011*). These species may or may not be present on the Refuge.

Common Name	Scientific Name
Globose dune beetle	*Coelus globosus*
Gabb's tiger beetle	*Cicindela gabbii*
Sandy beach tiger beetle	*Cicindela latesignata latesignata*
Frost's tiger beetle	*Cicindela senilis frosti*
Mudflat tiger beetle	*Cicindela trifasciata sigmoidea*
Wandering skipper	*Panoquina errans*

Reptiles and Amphibians

Presented below of reptile and amphibian species document on Naval Weapons Station Seal Beach (*U.S. Navy 2011*), some of these species have not been observed in recent years. These species may or may not be present on the Refuge.

Common Name	Scientific Name
Western fence lizard	*Scheloperus occidentalis*
Side-blotched lizard	*Uta stansburiana*
Southern alligator lizard	*Gerrhonotus multicarinatus*
Gopher snake	*Pituophis melanoleucus*
San Diego horned lizard	*Phrynosoma coronatum blainvillii*
Pacific tree frog	*Hyla regilla*

Mammal

This is a partial list of mammals that occur or historically occurred on Naval Weapons Station Seal Beach and are likely to be found on occasion on the Refuge (*U.S. Navy 2011*).

Common Name	Scientific Name
House mouse	*Mus musculus*
Western harvest mouse	*Reithrodontomys megalotis*
California vole	*Microtus californicus*
Botta pocket gopher	*Thomomys bottae*
California ground squirrel	*Spermophilus beecheyi*
Virginia opossum	*Didelphis virginiana*
Long-tailed weasel	*Mustela frenata*
Striped skunk	*Mephitis mephitis*
Black-tailed jackrabbit	*Lepus californicus*
Audubon's cottontail	*Sylvilagus audubonii*
North American badger*	*Taxidea taxus*
Gray fox*	*Urocyon cinereoargenteus*

* Historically occurred on Naval Weapons Station Seal Beach, but are now extirpated.

Appendix D

Request for Cultural Resource Compliance Form

REQUEST FOR CULTURAL RESOURCE COMPLIANCE
U.S. Fish and Wildlife Service, Region 1

Project Name:					**FWS Program:** (ES, Refuges, Fisheries, Fire…)	
					Funding Program: (Partners, Refuges, TEA-21, HCP, NAWCA…)	
State: CA, ID, HI, NV, OR, WA		**EcoRegion:** CBE, IPE,KCE, NCE			**FWS Unit: Org Code:**	
Project Location:	**County**	**Township**	**Range**	**Section**	**FWS Contact:** Name, Tel#, Address	
USGS Quad:					**Date of Request:**	**Proposed Project Start Date:**
Total project acres/ linear ft/m:		**APE Acres / linear ft/m** (if different)				

Have you consulted with Tribe(s)?				Have you consulted with other interested parties?				**Is there another federal agency involved with this project?**		No	If yes, provide name:
Yes		No		Yes		No				Yes	
MAPS Attached				**Check below**				**If yes, which agency is taking lead for Section 106 compliance?**		FWS	Other Agency
Copy of portion of USGS Quad with project area marked clearly **(required)**								Project (sketch) map showing Area of Potential Effect with locations of specific ground altering activities **(required)**			
Photocopy of aerial photo showing location **(if available)**								Any other project plans, photographs, or drawings that may help CRT in making determination **(if available)**			

Directions to Project: (if not obvious)	
Description of Undertaking:	Describe proposed project and means to facilitate (e.g., provide funds to revegetate 1 mile of riparian habitat, restore 250 acres of seasonal wetlands, and construct a 5-acre permanent pond). How is the project designed (e.g., install 2 miles of fence and create approximately 25' of 3' high check dam)?

Return Form and maps to: Virginia_parks@fws.gov
If unable to send digitally, mail or fax to USFWS Region 1 Cultural Resources Team, 20555 SW Gerda Lane, Sherwood, OR 97140
Questions: 503-625-4377 or fax 503-625-4887

Area of Potential Effects (APE):	Describe where disturbance of the ground will occur. What are the dimensions of the area to be disturbed? How deep will you excavate? How far apart are fenceposts? What method are you using to plant vegetation? Where will fill be obtained? Where will soil be dumped? What tools or equipment will be used? Are you replacing or repairing a structure? Will you be moving dirt in a relatively undisturbed area? Will the project reach below or beyond the limits of prior land disturbance? Differentiate between areas slated for earth movement vs. areas to be inundated only. Is the area to be inundated different from the area inundated today, in the recent past, or under natural conditions? Provide acres and/or linear ft/m for all elements of the project.
Environmental and Cultural Setting:	Briefly describe the environmental setting of the APE. **A)** What was the natural habitat prior to modifications, reclamation, agriculture, settlement? **B)** What is land-use history? When was it first settled, modified? How deep has it been cultivated, grazed, etc.? **C)** What is land use and habitat today? What natural agents (e.g., sedimentation, vegetation, inundation) or cultural agents (e.g., cultivation) might affect the ability to discover cultural resources? **D)** Do you (or does anybody else) know of cultural resources in or near the project area?
Please return this RCRC and map showing APE digitally, if possible, to virginia_parks@fws.gov. Questions, call 503-625-4377	

Return Form and maps to: Virginia_parks@fws.gov
If unable to send digitally, mail or fax to USFWS Region 1 Cultural Resources Team, 20555 SW Gerda Lane, Sherwood, OR 97140
Questions: 503-625-4377 or fax 503-625-4887

Seal Beach National Wildlife Refuge
San Diego National Wildlife Refuge Complex
P.O. Box 2358
Chula Vista, CA 91912
619/476-9150

California Relay Service
TTY 1 800/735-2929
Voice 1 800/735-2922

U.S. Fish & Wildlife Service
http://www.fws.gov

For Refuge Information
1 800/344 WILD (9453)

Cover Photo: Anaheim Bay Marsh Complex
Tim Anderson

May 2012