ENVIRONMENTAL ASSESSMENT

RESTORATION OF HORSESHOE POND TO A COASTAL LAGOON/TIDAL ESTUARY

Horseshoe Pond: View east towards Limantour Beach

Point Reyes National Seashore

National Park Service

June 21, 2004

Environmental Assessment

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PROJECT SUMMARY

Point Reyes National Seashore proposes the restoration of natural hydrologic and shoreline process to the Horseshoe Pond area of the historic D-Ranch. Horseshoe Pond is a former 35-acre coastal lagoon situated on the north side of Drakes Beach between the Ken Patrick Visitor's Center and the mouth of Drakes Estero. For hundreds of years, the Horseshoe Pond area functioned as a lagoon, controlled by the sand-dominated outlet to the west side of the beach interface. Horseshoe Pond was constructed as a road access to the hunting blind at the mouth of Drakes Estero in the late 1940s by filling across the sandy beach lagoon interface with upland fill. The facility has undergone major maintenance and modification since construction, including realignment in the 1970s and the installation of a cement spillway in the late 1980s.

The pond was part of the D-Ranch dairy operation acting as a water source and ultimate destination for much of the dairy waste. Constant maintenance of the dam facility was required as high seas constantly eroded and breached the dam facility. The pond breached in January 2002. The brackish waterbody is heavily influenced by tidal overwash into the pond area, as well as freshwater runoff. The configuration of the remaining dam structure prevents natural shoreline and hydrologic process from occurring at the site.

The objectives of the Horseshoe Pond Restoration Project are:

1. To restore natural hydrologic and coastal beach processes to the site,

2. Accelerate improvements to water quality in Horseshoe Pond towards stabilizing dissolved oxygen levels within normal range to improve the quality of the habitat for aquatic species.

3. To restore native dune function and habitat,

4. To protect stability of archaeological resource site of CA-MRN-394/H, and

5. To return the pond vicinity to a more natural appearing state by removing prominent evidence of construction.

This EA evaluates the potential environmental consequences of three alternative strategies for implementing the Horseshoe Pond Project. The Project Area incorporates Horseshoe Pond in its entirety, including the outflow channel, earthen berm, and dune and beach habitats, the quarry, areas selected for California red-legged frog mitigation, and a 25-ft corridor along access roads. Presented for public review are the NEPA-required No Action Alternative (Alternative A) which continues the current management strategy, an alternative which would remove only the spillway across the pond outflow (Alternative B), and an alternative which would remove the spillway, restore the historic outflow channel, restore the adjacent quarry, and close-out a portion of the access road to Horseshoe Pond (Alternative C). Common to both action alternatives (Alternatives B and C) is the conversion and enhancement of the former D-Ranch waste lagoon to a perennial pond for use by the California red-legged frog.

Matrix of treatment actions proposed under each alternative.

		Cement spillway and fill removal	Re-establishment of historic outlet	Quarry and access road closeout	CRLF habitat enhancement
Alternative A (No Action)					
Alternative B		X			X
Alternative C		X	X	X	X

The potential for direct impact, cumulative impact, and impairment of Geology and Soils; Water Resources, Aquatic Habitat and Hydrologic Processes; Vegetation; Introduce or Promote Non-Native Species; Wetlands; Cultural Resources; Tribal land use, sacred sites; and Special Status Species are evaluated as part of this Environmental Assessment. Five special status species including: California red-legged frog (*Rana aurora draytonii, Federal*

Threatened Species); pink sand verbena (*Abronia umbellata* ssp. *breviflora Federal Species of Concern*); marsh milkvetch (*Astragalus pycnostachyus* var. *pycnostachyus Federal Species of Concern);* San Francisco Bay spineflower *(Chorizanthe cuspidata* var. *cuspidata, Federal Species of Concern);* wooly headed spineflower (*Chorizanthe cuspidata* var. *villosa, Federal Species of Concern*) are evaluated in this document.

The NPS has selected Alternative C as the preferred alternative. Alternative C restores natural process to a coastal lagoon by removing the much of the constructed dam facility from the Drakes Beach area. Alternative C has also been identified as the environmentally preferred alternative. The project avoids further impacts to cultural resources (CA-MRN-394/H) while restoring natural process to the area. Alternative would require the least maintenance in the future and would provide the widest range in beneficial uses to this area of national trust lands. Alternative C also provides more aesthetic enhancement and restoration than Alternative B. Further, Alternative C reforms the engineered levees of Horseshoe Pond to be more compatible with the existing natural contours around the pond and removes more fill from the Project Area.

1.0 PURPOSE AND NEED

1.1 INTRODUCTION

The Horseshoe Pond Environmental Assessment (EA) has been developed in accordance with the 1969 National Environmental Policy Act (NEPA) for use by the National Park Service (NPS), other jurisdictional agencies, and the general public to deliberate the proposed restoration of Horseshoe Pond within the Point Reyes National Seashore (PRNS). The EA examines alternative means to restore hydrologic function to Horseshoe Pond and assesses the potential environmental effects of the implementation of each strategy. Following public and agency review and comment, the conclusions of potential environmental effect in the EA will be used to inform the NPS planning process. The EA may identify the need for further environmental review or may lead to a decision that the project's impacts are adequately assessed in conformance with NEPA. The latter outcome is published in a Finding of No Significant Impact (FONSI) which would outline the parameters and management measures for the implementation of a restoration project at Horseshoe Pond.

1.2 PROJECT NEED

Horseshoe Pond is a former 35-acre coastal lagoon situated on the north side of Drakes Beach between the Ken Patrick Visitor's Center and the mouth of Drakes Estero (Figure 1). The site lies within the historic D-Ranch which was operated as a dairy ranch from 1862 to 1998. For hundreds of years, the Horseshoe Pond area functioned as a lagoon, controlled by the sand-dominated outlet to the west side of the beach interface. The stability of this area is demonstrated by the presence of archeological resources and upland vegetation in the area now performing as the east-side outlet. Horseshoe Pond was constructed in the late 1940s by filling across the sandy beach lagoon interface with upland fill and cement structures. The resulting pond was part of the D-Ranch Dairy operation acting as a water source and ultimate destination for much of the dairy waste. Constant maintenance of the dam facility was required as high seas constantly eroded and breached the dam facility.

Several important changes to the hydrologic processes and the ecology of Horseshoe Lagoon occurred in association with the construction of the dam facility:

- An earthen dam was installed at the mouth of Horseshoe Pond. The dam has substantially altered natural flow regimes at Horseshoe Pond, impeding both natural outflow from the pond and inflow from the ocean during storm and high tide events.

- The input of manure to the system over many decades has resulted in a nutrient-overloaded system. Though inputs have been suspended since 1998, annual cycling of these stored nutrients still results in eutrophic conditions. Monitoring by NPS staff has noted fish kills resulting from massive algal blooms and variances in the levels of dissolved oxygen in the water.

- Upland vegetation and invasive dune species, including ice plant and European beach grass, have replaced native dune habitat that is now considered a rare plant community park-wide.

- The quarry used for the dam construction, area ranch roads, debris left over from the ranching period and the earthen dam itself with its concrete spillway all contribute to a degraded aesthetic scene in this area of the national park.

1.3 PROJECT PURPOSE

The primary goal of the proposed habitat restoration project is to restore natural hydrologic and ecological process to the section of Drakes Bay where Horseshoe Pond is located. Historic aerial photographs of the site and NPS experience with similarly functioning, unimpaired coastal ecosystems along the central California coast have developed the Horseshoe Pond Restoration Project to restore the Pond to a state closer to its original ecological and physical function. Restoration of water resources, aquatic and dune

habitats has been identified as high priority objectives by the NPS in the PRNS General Management Plan (NPS 1980), the PRNS Resource Management Plan (NPS 1990) and NPS Management Policies (NPS 2000).

NPS Management Policies, Section 4.1.5, directs actions to restore natural systems in the national parks. The NPS is directed to:

> "re-establish natural functions and processes in human-disturbed components of natural systems in parks unless otherwise directed by Congress…..Impacts to natural systems resulting from human disturbances include the introduction of exotic species; the contamination of air, water, and soil; changes to hydrologic patterns and sediment transport; the acceleration of erosion and sedimentation; and the disruption of natural processes. The Service will seek to return human-disturbed areas to the natural conditions and processes characteristic of the ecological zone in which the damaged resources are situated. (NPS 2000, p. 30)

Section 4.8.1.1 of the NPS Management Policies addresses the management objective to restore natural shoreline process to this section of Drakes Bay.

> "Natural shoreline processes (such as erosion, deposition, dune formation, overwash, inlet formation, and shoreline migration) will be allowed to continue without interference. Where human activities have altered the nature or rate of natural shoreline process, the Service will… investigate alternatives for mitigating the effects of such activities or structures, and for restoring natural conditions."

Section 4.6.5 of the NPS Management Policies addresses the restoration of wetlands on NPS lands. Wetlands comprise most of the Horseshoe Pond Project Area.

> "When natural wetland characteristics or functions [of wetlands] have been degraded or lost due to previous or on-going human actions, the Service will, to the extent practicable, restore them to predisturbance conditions." (NPS 2000, p. 40)

Section 4.6.3 of the NPS Management Policies supports the project objective to improve water quality in Horseshoe Pond project area

> "The pollution of surface waters and groundwaters by both point and non-point sources can impair the natural functioning of aquatic and terrestrial ecosystems, and diminish the utility of park waters for visitor use and enjoyment…..The Service will ….Take all necessary actions to maintain or restore the quality of surface waters and ground waters within the parks consistent with the Clean Water Act and all other applicable federal, state, and local laws and regulations…"

Section 4.6.6 of the NPS Management Policies supports the project objective to restore natural hydrologic process to the Horseshoe Pond project area.

> "The Service will manage watersheds as complete hydrologic systems… The Service will achieve the protection of watershed and stream features … by allowing natural fluvial processes to proceed unimpeded."

As set forth in the 1962 legislation that created PRNS, projection of the unique coastal resources in the park is a primary purpose for its establishment ….

> "…to save and preserve, for the purposes of public recreation, benefit, and inspiration, a portion of the diminishing seashore of the United States that remains undeveloped" (PL 87-657).

An amendment to the legislation passed in 1976 (PL 94-544) provides the NPS with specific management goals for PRNS.

> "…the property … shall be administered …without impairment of its natural values, in a manner which provides for such recreational, educational, historic preservation, interpretation, and scientific research opportunities as are consistent with, based upon, and supportive of the maximum protection, restoration, and preservation of the natural environment within the area."

The current PRNS General Management Plan (NPS 1980) and Statement for Management (NPS 1990) identify objectives for the management of natural and cultural resources. The PRNS Statement for Management sets the primary resource management objectives for PRNS as the identification, protection, perpetuation, and restoration of significant cultural and historic resources and of the diversity of natural ecosystems representative of the California coast (NPS 1993).

The objectives of the Horseshoe Pond Restoration Project are:

1. To restore natural hydrologic and coastal beach processes to the site,

2. Accelerate improvements to water quality in Horseshoe Pond towards stabilizing dissolved oxygen levels within normal range to improve the quality of the habitat for aquatic species.

3. To restore native dune function and habitat,

4. To protect stability of archaeological resource site of CA-MRN-394/H, and

5. To return the pond vicinity to a more natural appearing state by removing prominent evidence of construction.

To accomplish these objectives, PRNS intends to remove much of the earthen dam and concrete spillway at Horseshoe Pond that currently restricts natural hydrologic and coastal beach process at the site. These actions alone would return the site from an oligohaline pond to a coastal lagoon. Restoration of Horseshoe lagoon could require the complete removal of the current spillway structure and re-establishment of the historic outflow channel on the west side of the site. PRNS additionally proposes to extend restoration tasks to sites and habitats adjacent to Horseshoe Pond in order to address site rehabilitation at the landscape level. These actions include rehabilitation of the quarry where original fill for the dam was obtained, closeout of former ranch roads, and enhancement of former farm ponds for wildlife habitat.

Consistent with the above objectives, funding has been obtained through the NPS Dam Safety and Water Resource Competitive Programs and the Point Reyes National Seashore Association to restore Horseshoe Pond to its original, natural function as a coastal lagoon. The action alternatives proposed within this EA are designed to meet some or all of the restoration objectives identified in the original funding proposals.

The passage by Congress of the Government Performance Results Act of 1993 (GPRA) mandated that the NPS and all government agencies define measurable management goals and tie public funding expenditures to the achievement of those goals and objectives. In response, the NPS defined hierarchical GPRA goals that relate primarily to natural and cultural resource protection, visitor satisfaction and organizational effectiveness. Mission Goal Ia states, "Natural and cultural resources and associated values are protected, restored and maintained in good condition and managed within their broader ecosystem and cultural context." The project is consistent with National Park Service GPRA goal Ia1A related to disturbed land restoration.

1.4 PROJECTS CONSIDERED IN CUMULATIVE IMPACTS ANALYSIS

1.4.1 Description of projects considered in cumulative impact analysis

The proposal to restore the Horseshoe Pond area is one of several current water resource restoration projects currently in the planning process that are proposed for the improvement and/or enhancement of PRNS water resources. Best Management Practices and mitigation measures developed in this EA for the

Horseshoe Pond project may provide valuable protocol for subsequent implementation of the other restoration efforts. These projects include:

- Coastal Watershed Enhancement Project – This project includes the replacement of culverts and the restoration of natural hydrologic process at nine sites within the Drakes Estero Watershed. The project is in the planning Phases, with Environmental Assessments to be released by spring 2004. The project will entail the removal of two dam facilities, one that is documented to provide breeding habitat to the California red-legged frog.

- Glenbrook Dam and Quarry Restoration Project – This project involves the removal of dam remains and restoration of the borrow areas at the mouth of Glenbrook Creek within Estero de Limantour. This project planning and implementation are being conducted on the same general schedule. In addition, the project will require the same permits as those for Horseshoe Pond, and in addition, Minimum Tool clearance for operations within the Wilderness.

- Dune Restoration Project. – This project involves the removal of non-native European beach grass from the dune areas within the Seashore. Methods of removal and restoration strategies are currently being tested near Abbotts Lagoon and will be employed at a larger scale under a Line-Item Construction project planned for FY 2007.

- Giacomini Wetland Restoration Project – The park is in the planning stages concerning the restoration of a 563-acre property at the head of ecologically sensitive Tomales Bay. The property is protected behind levees and supports a dairy operation. The restoration planning will be completed by FY2006, with activities associated with the restoration likely to begin in 2007. The project objectives would result in the restoration of natural hydrologic and estuarine process to a large portion of the property, for the purpose of ecological restoration. An EIS will be conducted for potential impacts associated with the proposed actions at this location.

- Fire Management Program – The Seashore has completed a Fire Management Plan and is conducting environmental analysis program alternatives. The preferred alternative would result in prescribed fire and mechanical treatment on no more than 3,000 acres per year within park fire management units (FMUs). While 27% of the Drakes Bay/Drakes Estero watershed is included in the plan as active treatment FMUs, the NPS does not anticipate treatment on more than 10% of any one watershed within Drakes Bay in any given year.

- General Management Plan – Point Reyes National Seashore is in the process of revising the park General Management Plan. This is a long-term strategic planning document that will establish management direction in the park for the next 10 to 20 years. Public scoping has been conducted and the NPS anticipates the planning process to be completed by FY 2006 or 2007.

1.5 ISSUES RAISED DURING PROJECT SCOPING

1.5.1 Public Scoping

Project scoping was conducted between July 19, 2002 and August 19, 2002. The scoping document was sent to the park friends mailing list including more than 200 addresses of agencies and interested parties. A total of 3 comments were submitted to the NPS regarding this proposed project. Issues raised in these responses are listed below and are addressed within this Environmental Analysis.

Special Status Species – Plants
Concern over potential impacts to *Abronia umbellata ssp. breviflora*, a plant listed in the California Native Plant Society's Inventory of Rare and Endangered Plants as Category 1B meaning "rare, threatened or endangered in California and elsewhere (CNPS, 2004). The comment related that because low numbers of plants exist in the Seashore, the population in this area is at risk.

Wildlife - Birds

Comments by the public emphasized the location of the area by various avian species and that, "restored, Horseshoe Pond could be a significant avian habitat." This supports the proposed project to restore natural process to the area.

1.5.2 Internal Scoping

The NPS has conducted public scoping (described in Section 1.5.1) as well as conducting internal staff scoping that served as the basis for the scope of the EA. In internal scoping, the NPS examines potential environmental issues relevant to the proposal that are raised by NPS staff. Those issues with potential for effect are addressed in this EA.

1.6 IMPACT TOPICS ADDRESSED IN THE EA

The following impact topics were determined through the scoping process to have the potential for impact on the environment and comprise the impact topics to be addressed in the EA.

Geology and Soils. Project implementation would involve the use of heavy equipment to remove the spillway and possibly Horseshoe Pond Dam, to recontour and prepare the road, quarry area and Enhancement Project area for revegetation. Project actions could result in increased erosion and changes in the existing topography. The effect of project actions on site soils and topographic features will be addressed in the EA.

Water Resources, Aquatic Habitat and Hydrologic Processes. The project proposes to restore natural hydrologic and shoreline process to the Horseshoe Pond area. Topics evaluated as part of this section include Shoreline Process / Marine and Estuarine Resources, Aquatic Habitat, Salinity Regime, and Water Quality. Manipulation of the system may result in impacts to wetland and water quality resources within the area. Projects that may result in impacts to water quality are required to obtain permits through the Regional Water Quality Control Board under Section 401 of the Clean Water Act. Additional regulations protecting wetlands are described separately.

Vegetation. Sand has deposited on the eastern half of the berm, which flanks the open beach in front of Horseshoe Pond, has created superficial dune features attracting characteristic dune vegetation, including *Lupinus arboreus* (yellow bush lupine), *Abronia latifolia* (sand verbena), *Carpobrotus edulis* (ice plant), *Cakile maritima* (searocket), and *Ammophila arenaria* (European beachgrass). Stabilization associated with the dam structure has created a setting that supports non-native European beach grass and ice plant. This area is isolated from other source areas of non-native dune species by the cliffs along Drakes Beach. As with any restoration project of this type, there will be ground and vegetation disturbance. This topic is included in the scope of the EA to ensure that adequate measures are taken regarding site regrading and any potential planting plans.

Introduce or Promote Non-Native Species. As with any restoration project, ground disturbance could increase non-native species plant species at the site. The project area is a historic ranch and the former pasturelands are dominated by non-native grasses. Along the beach interface, non-native beach grass and ice plant would be treated and monitored for regrowth. Project impacts on non-native species will be addressed under the impact topic of Vegetation.

Wetlands. A significant portion of the project area includes tidal and freshwater wetland resources. Wetlands are protected and regulated through a variety of measures including the Clean Water Act, River and Harbors Act, Executive Order 11990, NPS Director's Order 71, and the California Coastal Commission Coastal Zone Management Act. The US Army Corps of Engineers is the agency responsible for enforcement and permitting under Section 404 of the Clean Water Act and Section 10 of the River and Harbors Act. This project would also require a coastal permit from the California Coastal Commission. Through Directors Order 71-A, the NPS has established policy and guidelines to comply with Executive Order 11990.

Special Status Species. The project area has been documented to support a variety of special status plant and animal species including species listed under the federal Endangered Species Act or listed as a species of concern by the US Fish and Wildlife Service. Based on site surveys and document review, the NPS determined that the project could impact the following species:

- California red-legged frog (*Rana aurora draytonii, Federal Threatened Species)*
- pink sand verbena (*Abronia umbellata* ssp. *breviflora Federal Species of Concern*),
- marsh milkvetch (*Astragalus pycnostachyus* var. *pycnostachyus Federal Species of Concern)*
- San Francisco Bay spineflower *(Chorizanthe cuspidata* var. *cuspidata, Federal Species of Concern*
- wooly headed spineflower (*Chorizanthe cuspidata* var. *villosa, Federal Species of Concern*)

Evaluation of all other species that occur within the project area determined that the project would result in negligible impacts or have no effect.

Important Fish and Wildlife Habitat. The current water body provides important wildlife habitat for birds and the California red-legged frog. With restoration of shoreline processes, the improvements to aquatic habitat would also improve bird habitat by increasing food sources. Improvements to water quality associated with restored hydrologic patterns could increase use of the aquatic habitat by fish species. Habitat issues associated with the California red-legged frog are addressed in the Special Status Species section.

Cultural Resources. Through internal scoping, it was determined that the project area includes an archaeological resource site that had not been documented in more than 40 years. Through the project planning process, the NPS has worked with the Federated Indians of Graton Rancheria (FIGR) and the Anthropological Studies Center of Sonoma State University to document the resources at the site. The proposed project is a result of this collaboration and would avoid impacts to these resources.

Tribal land use, sacred sites. An archeological site documented in 1960 was rediscovered for the first time during project planning for Horseshoe Pond restoration. The location of the archeological site was considered in redesigning the proposed action and limits of site disturbance during implementation. The cultural resources study was undertaken in consultation with the Federated Indians of Graton Rancheria, the recognized affiliated tribe, and helped to define restoration boundaries. The NPS will coordinate with the FIGR to insure that either an NPS or FIGR representative is on site during the construction activities. This project may also include work to stabilize and protect the existing site. Tribal consultation will be addressed in the EA as part of the impact assessment to cultural resources.

1.7 IMPACT TOPICS DISMISSED FROM FURTHER ASSESSMENT

The purpose of an EA is to identify whether or not a proposal could have a significant effect on the environment. Therefore, the EA focuses on those issues with potential for effect to determine the degree of effect that could result from implementation. Through project scoping, it was determined that project implementation would have a less than significant effect on the impact topics listed below. .

Geohazards are not addressed in the scope of the EA as there are no structures or recreational facilities that would result in the exposure of visitors or staff to geologic hazard.

Air Quality affects would be short-term, negligible and adverse from the generation of pollutants from heavy equipment and blowing dust particles during the brief construction period.

Soundscapes Construction activities would temporarily disrupt natural quiet in the immediate project area. Steep topography in the project area would attenuate the potential sounds from construction activities, as would the high natural ambient noise from wind and water action. Noise from construction activities would only be generated during working hours, and would cease immediately upon project completion. No repetitive damaging sounds, such as those caused by explosions or rapid impacts, would be generated. The proposed project's effect on natural quiet would be local, short-term, adverse, and negligible. As there is no

potential for significant impact to natural soundscapes as a result of this project, there will be no further analysis regarding this impact topic.

Stream Flow Characteristics. The project would occur within a lagoon and beach area and would not affect the character, location, or amounts of streamflow within the watershed or project area.

Land use and socioeconomics impacts. The project area provides open space, wildlife habitat and passive recreational use within PRNS. The project would result in a change from current land use pattern.

Unique Ecosystems, biosphere reserves. The project area is along the coastal margin within the Golden Gate Biosphere Reserve. The project is proposed in recognition of this unique ecosystem and would improve natural hydrologic and ecological function to the area.

Visitor Experience and Aesthetic Resources. The proposed project would improve aesthetic resources in this area through removal of the concrete spillway; recontouring and revegetate disturbed areas of the landscape, rehabilitating the waste lagoon and remove debris.

Public Access and Recreation. During project implementation, the project area would be closed for reasons of public safety. Public access to the beach would remain available during the duration of the project. Project implementation would not preclude future siting of a trail in this area. The project impacts to public access and recreation would be negligible and short-term.

Disproportionate affect on Minority and low income populations. The proposed actions are resource focused and would not result in changes to any user demographic including minority or low income user groups.

Energy resources. The proposed project does not involve the sustained use of energy supplies. The action alternatives would have a short-term, negligible adverse affect on energy resources.

Prime and Unique Farmlands. The project area does not occur within any areas mapped as having prime and unique farmland.

1.8 RELEVANT LAWS, REGULATIONS, AND POLICIES

This section describes key legislation that form the legal context and important NPS policies that direct NPS actions relevant to the *Restoration of Horseshoe Pond to Coastal Lagoon Environmental Assessment*. Legislation specific to PRNS and NPS Management Policies relevant to the proposed project were discussed in Chapter 1, Section 1.3, Project Purpose.

1.8.1 National Park Service Legislation and Policy

National Park Service Organic Act of August 25, 1916, PL 64-235, 16 USC §1 et seq. As amended. On August 15, 1916, Congress created the NPS with the NPS Organic Act. This act, as reaffirmed and amended in 1970 and 1978, establishes a broad framework of policy for the administration of national parks:

> "The Service thus established shall promote and regulate the use of the Federal areas known as National Parks, Monuments, and Reservations… by such means and measures as to conform to the fundamental purpose of the said Parks, Monuments, and Reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

The National Parks Omnibus Management Act of 1998 (SB 1693) provides for improved management and increased accountability for NPS programs. Specifically, Title I, Sec. 101 states, “Recognizing the

ever increasing societal pressures being placed upon America's unique natural and cultural resources contained in the National Park System, the Secretary shall continually improve the ability of the NPS to provide state-of-the-art management, protection, and interpretation of and research on the resources of the National Park System." In Title II, Sec 201, the stated purposes of the National Park System resource inventory and management programs are to 1) more effectively achieve the mission of the NPS, 2) enhance the management and protection of national park resources by providing clear authority and direction for the conduct of scientific studies and to use the information gathered for management purposes, 3) ensure appropriate documentation of resource conditions in the National Park System, and 4) encourage others to use the National Park System for study to the benefit of park management as well as broader scientific value where consistent with the Organic Act.

Point Reyes Wilderness Area (PL 94-567) established the Point Reyes Wilderness Area. In 1985 (PL 99-68), Congress designated the Point Reyes wilderness area as the Philip Burton Wilderness in recognition of this congressman's dedication to the protection of the nation's resources and role in the establishment of national parks in the San Francisco Bay Area.. Areas that had been designated as potential wilderness (Muddy Hollow, Limantour, and Abbotts Lagoon) were changed to full wilderness status through notice in the Federal Register on November 18, 1999. The Project Area is not within the Philip Burton Wilderness Area.

NPS Management Policies, 2001. This document contains Service-wide policies of the NPS. . Adherence to policy is mandatory unless specifically waived or modified by the Secretary, the Assistant Secretary, or the Director of NPS. In addition to sections cited in Chapter 1, Section 3 of this EA, other sections relevant to the proposed actions are Section: 4.4.2.4 - Management of Natural Landscapes; 4.6.4 – Floodplains; 4.6.6 – Watershed and Stream Processes; 4.8.1.1 – Shorelines and Barrier Islands; and 9.5 - Dams and Reservoirs.

1.8.2. Federal environmental Legislation and Regulations

National Environmental Policy Act (NEPA) of 1970. PL 91-190, 83 Stat. 852, 42 USC §4341 et seq. The NEPA process is intended to help public officials make decisions that are based on understanding of environmental consequences, and take actions that protect, restore, and enhance the environment. Regulations implementing NEPA are set forth by the Council on Environmental Quality. This document has been prepared following NPS Directors Order 12 meeting Department of Interior and NPS standards.

Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (NEPA) (40 CFR Parts 1500-1508). The Council on Environmental Quality regulations for implementing NEPA establishes the process by which federal agencies fulfill their obligations under the NEPA process. The Council on Environmental Quality regulations ascertains the requirements for environmental assessments and environmental impact statements that document the NEPA process. The Council on Environmental Quality regulations also defines such key terms as "cumulative impact," "mitigation" and "significantly" to ensure consistent application of these terms in environmental documents. This environmental analysis was prepared as directed in the Council on Environmental Quality regulations.

Clean Air Act, as amended, PL Chapter 360, 69 Stat. 322, 42 USC §7401 et seq. Section 118 of the Clean Air Act requires all federal facilities to comply with existing federal, state, and local air pollution control laws and regulations.

Federal Water Pollution Control Act (Clean Water Act) and subsequent amendments of 1977 (33 USC 1251 et seq.). The Clean Water Act provides for the restoration and maintenance of the physical, chemical, and biological integrity of the nation's waters. Section 404 of the act prohibits the discharge of fill material into navigable water of the United States, including wetlands, except as permitted under separate regulations by the U.S. Army Corps of Engineers and U.S. Environmental Protection Agency. The project will be conducted within jurisdictional wetlands as confirmed by the US Army Corps of Engineers August 13, 2002. The project will require 404 permits through the Corps, and 401 certification through the San

Francisco Regional Water Quality Control Board. Application for these permits will be submitted subsequent to the Environmental Assessment.

Rivers and Harbors Act (1899)
Predating the Clean Water Act, the jurisdiction of the US Army Corps was limited to waters subject to Section 10 of the Rivers and Harbors Act (1899). The Corps continues to oversee Section 10 jurisdictional waters, which are navigable waters that are subject to the ebb & flow of the tide, and/or those that are presently used, have been used in the past, or could be used for interstate transport or foreign commerce. Section 10 jurisdiction extends to mean high water (MHW) and includes tidal areas presently subject to tidal influence, as well as unfilled areas currently behind levees that were historically below MHW. Section 10 jurisdiction also extends upstream to the ordinary high water (OHW) of non-tidal waters designated as navigable waters of the United States. The US Army Corps regulates and permits Section 10 in addition to CWA Section 404. The US Army Corps of Engineers jurisdictional delineation (August 13, 2002) confirmed that the project is outside of waters regulated under Section 10.

Coastal Zone Management Act. This act protects coastal environments. While this act transferred regulatory authority to the States and excluded federal installations from the definition of the "coastal zone," it requires that federal actions be consistent with state coastal management plans. Activities taking place within the coastal zone under the definition established by the California Coastal Management Plan require a federal consistency determination. This project will require federal consistency review by the California Coastal Commission. . Application for these permits will be submitted subsequent to the Environmental Assessment.

Endangered Species Act of 1973, as amended, PL 93-205, 87 Stat. 884, 16 USC §1531 et seq. The Endangered Species Act protects threatened and endangered species from unauthorized "take", and directs federal agencies to ensure that their actions do not jeopardize the continued existence of listed species. Section 7 of the act defines federal agency responsibilities for consultation with the U.S. Fish and Wildlife Service, or the National Marine Fisheries Service for fish and marine mammal species. Consultation requires preparation of a Biological Assessment to identify any threatened or endangered species that is likely to be affected by the proposed action. The NPS has initiated consultation with the U.S. Fish and Wildlife Service and NOAA Fisheries regarding this project.

Wilderness Act of 1964 (P.L. 88-577). Established a National Wilderness Preservation System, allowing Congress to designate wilderness areas for preservation and protection of their natural condition. "The areas shall be administered… in such a manner as will leave them unimpaired for future use and enjoyment as wilderness." Wilderness is defined in the act as "an area where the earth and community of life are untrammeled by man, where man himself is a visitor who does not remain." This project is not within designated wilderness.

1.8.3. Cultural Resources Legislation

Antiquities Act of 1906, PL 59-209, 34 Stat. 225, 16 USC §432 and 43 CFR 3. This act provides for the protection of historic or prehistoric remains, "or any antiquity," on federal lands. It protects historic monuments and ruins on public lands. It was superseded by the Archeological Resources Protection Act (1979) as an alternative federal tool for prosecution of antiquities violations in the National Park System.

Archeological Resources Protection Act of 1979, PL 96-95, 93 Stat. 712, 16 USC §470aa et seq. and 43 CFR 7, subparts A and B, 36 CFR. This act secures the protection of archeological resources on public or Indian lands and fosters increased cooperation and exchange of information between private, government, and the professional community in order to facilitate the enforcement and education of present and future generations. It regulates excavation and collection on public and Indian lands. It requires notification of Indian tribes who may consider a site of religious or cultural importance prior to issuing a permit. The act was amended in 1988 to require the development of plans for surveying public lands for archeological resources and systems for reporting incidents of suspected violations.

National Historic Preservation Act of 1966, as amended, PL 89-665, 80 Stat. 915, 16 USC §470 et seq. and 36 CFR 18, 60, 61, 63, 68, 79, 800. The National Historic Preservation Act requires agencies to take into account the effects of their actions on properties listed in or eligible for listing in the National Register of Historic Places. The Advisory Council on Historic Preservation has developed implementing regulations (36 CFR 800), which allow agencies to develop agreements for consideration of these historic properties. The NPS, in consultation with the Advisory Council, the California State Historic Preservation Officer (SHPO), American Indian tribes and the public, has developed a Programmatic Agreement for operations and maintenance activities on historic structures. This 1995 Programmatic Agreement (available on the web at http://www.achp.gov/npspa1.html) provides a process for compliance with National Historic Preservation Act, and includes stipulations for identification, evaluation, treatment, and mitigation of adverse effects for actions affecting historic properties.

American Indian Religious Freedom Act, PL 95-341, 92 Stat. 469, 42 USC §1996. This act declares policy to protect and preserve the inherent and constitutional right of the American Indian, Eskimo, Aleut, and Native Hawaiian people to believe, express, and exercise their traditional religions. It provides that religious concerns should be accommodated or addressed under NEPA or other appropriate statutes.

1.8.4 Executive Orders

Executive Orders are issued by the Office of the President and apply to all Federal agencies.

Executive Order 11593: Protection and Enhancement of the Cultural Environment. This Executive Order instructs all federal agencies to support the preservation of cultural properties. It directs them to identify and nominate cultural properties under their jurisdiction to the National Register of Historic Places and to "exercise caution… to assure that any federally owned property that might qualify for nomination is not inadvertently transferred, sold, demolished, or substantially altered."

Executive Order 11988: Floodplain Management. This Executive Order requires federal agencies to avoid, to the extent possible, adverse impacts associated with the occupancy and modification of floodplains, and to avoid development in floodplains whenever there is a practical alternative. If a proposed action is found to be in the applicable regulatory floodplain, the agency shall prepare a floodplain assessment, known as a Statement of Findings.

Executive Order 11990: Protection of Wetlands. This Executive Order established the protection of wetlands and riparian systems as the official policy of the federal government. It requires all federal agencies to consider wetland protection as an important part of their policies and take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands.

Executive Order No. 13112: Invasive Species. This Executive Order prevents the introduction of invasive species and directs federal agencies to not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species. Actions proposed in the *Restoration of Horseshoe Pond to Coastal Lagoon Environmental Assessment* include measures to prevent the introduction and spread of invasive species.

1.8.5 Relationship to Other Plans and Policies

Marin County Local Coastal Program, Unit 1 *(LCP)(1980)* supports and encourages the enhancement of public recreational opportunities. Referring to PRNS and GGNRA, the LCP states "public access to these lands seems to be assured." The LCP assumes that a major portion of the access and visitor services needs within Unit I would and can be successfully integrated into federal park development and management programs. The Seashore has determined that the project is within the Local Coastal Planning area, and will require federal consistency review by the California Coastal Commission.

Marin County Community Plan. PRNS and the GGNRA North District are part of the Marin County Coastal Recreation Corridor. The Countywide Plan recommends that PRNS and GGNRA be retained in their natural state to the greatest extent possible, and that recreation uses be low intensity. The County Community Plan is currently undergoing a revision.

Resources Management Plan. The Resources Management Plan (RMP) for the park was updated in 1999. The Plan presents an inventory and description of natural and cultural resources; describes and evaluates the current resources management program; and prescribes an action program based on legislative mandates, NPS policies, and provisions of related planning documents. Restoration of Horseshoe Pond to Coastal Lagoon is identified in the RMP.

PRNS General Management Plan Update. The planning process to update the 1980 PRNS General Management Plan (GMP) is in progress; scoping for the GMP update has been conducted. The process is expected to take 4-5 years. The Horseshoe Pond project is consistent with the mission and objectives of the NPS and the existing GMP. The NPS continues to implement the goals of the 1980 GMP and the direction and guidance it provides, while updating specific actions, such as the Horseshoe Pond project, through the NEPA and planning processes in conformance with NPS policies.

2.0 DESCRIPTION OF THE PROJECT ALTERNATIVES

This EA evaluates the potential environmental consequences of three alternative strategies for implementing the Horseshoe Pond Project. The Project Area incorporates Horseshoe Pond in its entirety, including the outflow channel, earthen berm, and dune and beach habitats, the quarry, areas selected for California red-legged frog mitigation, and a 25-ft corridor along access roads (see Figure 6). Presented for public review are the NEPA-required No Action Alternative (Alternative A) which continues the current management strategy, an alternative which would remove only the spillway across the pond outflow (Alternative B), and an alternative which would remove the spillway, restore the historic outflow channel, restore the adjacent quarry, and close-out a portion of the access road to Horseshoe Pond (Alternative C). Common to both action alternatives (Alternatives B and C) is the conversion and enhancement of the former D-Ranch waste lagoon to a perennial pond.

Table 1. Matrix of treatment actions proposed under each alternative.

		Cement spillway and fill removal	Re-establishment of historic outlet	Quarry and access road closeout	CRLF habitat enhancement
Alternative A (No Action)					
Alternative B		X			X
Alternative C		X	X	X	X

2.1 ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

Figure 6 shows where restoration activities would occur under Alternatives B and C.

2.1.1 Potential California Red-Legged Frog Enhancement Site

Located to the immediate south of the D-Ranch facility, the Enhancement Site was built in 1982 and used as a waste lagoon until the dairy closed in 1998. Though stored manure was removed and levees breached in 1998, the pond remains severely impacted by the organic materials remaining within the facility. The clay-lined pond is up to 8 feet deep and surrounded by a very steep and high levee on all sides. The pond provides little to no habitat value. Constructed as a waste lagoon, the only source of water entering the pond is rainfall, which keeps the pond wet most of the year. Isolated pockets have remained wet since the pond was last used for the dairy ranch in 1998. With no source of sediment flowing into the pond, the lifespan of the pond after restoration would be relatively long and the year-round wetness would provide high habitat values.

The restoration and enhancement of this site would include the regrading the pond walls to a lower elevation and more gradual slope. Currently the levees are at a 2:1 grade. This slope could be reduced to a 4:1 slope or lower using a bulldozer. Regrading the levees would involve moving 4,500 cubic yards of fill material. The levees are overgrown with non-native weed and thistle species. The area adjacent to the levees would be covered with fill as the levee slopes are graded out. Prior to grading, the topsoil from the adjacent area would be excavated and stockpiled to be spread over the regraded areas. Willow sprigs, typha (cattail), bulrush and other native riparian vegetation would be collected from the pond areas adjacent to the Ken Patrick Visitors Center and would be planted along the edge of the pond to provide cover and habitat for aquatic species

The site is in a relatively flat area and surrounded by heavy grass cover. Erosion is not expected to be accelerated during the first year after the project. The site would be monitored for growth of non-native invasive weed species. These species would be targeted and removed by PRNS staff.

2.1.2 Construction Timeline

Construction at the site would occur between August 15 and October 15. This timing avoids the bird and amphibian breeding seasons, and insures that annual plants have seeded out. In addition, this is the calm marine season, and is the driest part of the year. We expect water levels to recede away from the proposed areas of construction minimizing direct and indirect impacts of construction to water resources.

2.2 ALTERNATIVE A -NO ACTION ALTERNATIVE

Under the No Action alternative, current conditions and trends in Horseshoe Pond would remain unchanged. The majority of the dam would remain in place, although earthen material flanking the concrete spillway would continue to erode. The breach in the spillway that occurred in 2002 has resulted in reduced storage, expanded tidal mixing, and expansion of emergent wetland habitat from former water level of the pond to the new, lower waters edge. The remains of the remnant earthen dam at the pond/beach interface would continue to restrict hydrologic process and tidal exchange through the outflow channel.

2.2.1 Attainment of Project Objectives

This alternative does not achieve any of the project objectives described under Purpose and Need.

2.3 ALTERNATIVE B – SPILLWAY REMOVAL AND HABITAT ENHANCEMENT

Alternative B would remove only the concrete spillway and associated berm spanning the pond outflow, allowing enhanced tidal exchange through this channel and facilitating movement of aquatic species in and out of the system. Limited tidal access currently exists within the system, and this alternative may not substantially alter the hydrologic regime from current conditions. The recent tidal regime adjustments may have reduced breeding activities of California red-legged frogs in the pond. The red-legged frog is a federally-listed threatened species under the Endangered Species Act. Alternative B includes work at a potential California red-legged frog habitat enhancement site which expands breeding habitat within the park.

2.3.1 Concrete Spillway Removal

The road leading from D-Ranch, which crosses the front of Horseshoe Pond would be used to access the concrete spillway and associated berm spanning the current outflow channel. As shown in Figure 7, heavy equipment would be operating within a 30-foot wide swath centered on the spillway disturbing approximately 0.27-acres. The dimensions of the concrete spillway are 60-ft.x 12-ft.x 3-ft. This spillway and all reinforcing rip-rap protecting it would be broken up and completely removed from the site. Remnants of the spillway would be stockpiled behind the dairy barns at the D-Ranch facility.

The remaining soil fill would be excavated down to the existing grade. Approximately 90cubic yards of additional fill flanking the spillway would also be excavated and removed. The fill material would be hauled to the D-Ranch staging area. This material would be stockpiled at the D-Ranch site for use at a later time by the PRNS Maintenance staff.

Soils and banks left exposed following removal of the spillway would be allowed to revegetate naturally from the adjacent wetland vegetation. The area surrounding the concrete spillway has a gradual slope and would generate minimal water velocities. No erosion control treatment is anticipated. .

This portion of the project would require use of an excavator and a dump truck. All site recontouring and compaction can be accomplished with the excavator.

2.3.2 Attainment of Project Objectives

This alternative attains only project objectives 2 and 5 as described under Purpose and Need. In addition, the only benefit to ecological function under this alternative would occur at the frog enhancement site, and not within the Horseshoe Lagoon area itself.

2.4 ALTERNATIVE C – REESTABLISHMENT OF NATURAL HYDROLOGIC AND SHORELINE PROCESS WITH HABITAT ENHANCEMENT (PREFERRED ALTERNATIVE)

Restoration of Horseshoe Pond under Alternative C would include the removal of the spillway, re-establishment of the historic outflow channel and natural hydrologic process, restoration of the quarry, and close-out of the road leading to Horseshoe Pond. Alternative C also includes the California red-legged frog habitat enhancement site common to both action alternatives.

2.4.1 Concrete Spillway Removal

Removal of the concrete spillway and adjacent fill would be conducted as described under Alternative B, except that the fill would be retained within the Project Area for use in restoration of the quarry site. Any material not deemed suitable for quarry restoration would be stockpiled at the D Ranch staging area.

2.4.2 Re-establishment of Historic (western) Outlet

In order to restore the historic channel at the western end of the dam, a 220-yard wide -section of the dam (approximately 5,000 cubic yards) would be excavated and moved to the adjacent quarry (Figure 8). Topsoil from the dam would be scraped from the area and removed to a stockpile area. The topsoil material recovered from the site would be used as described under Section 2.4.3. Historically, the western channel was a wide sand flat (Figure 2). Since the dam was constructed, saltgrass (*Distichlis spicata*) and rushes (*Juncus lesueurii* and *Scirpus pungens*) have revegetated the area and would need to be partially cleared to recreate the channel from the pond to the beach.

Heavy equipment use would impact a total area of roughly 2.25-acres in complete the restoration of the historic channel. The excavator would work upstream and downstream of the dam to clear a small 'starter' channel in the historic overwash area. The excavator would take fill from the lower area and move it up to the dam. The fill would be loaded into the dump truck with a loader and transported to the quarry. Compaction and recontouring at the quarry would be performed with the bulldozer and finished with the excavator (see section 3.4.3).

The channel excavation would focus on the removal of debris and vegetation that could prevent a return to a dynamic tidal sand beach interface. Surveys would be conducted to ensure that the restored outlet is lower than the current outlet to the east.

Approximately 5,000 cubic yards of fill would be removed from the western-most, 220-yard section of the dam. The dam was originally constructed by pushing material out onto the sandy beach. It is likely that fill material has spread out and down into the surrounding, sand substrate. The majority of this work would be performed last after channel excavation. The excavator would operate from the dam and dig down approximately 2 feet below surrounding contours, or until the bottom of fill material is identified.

2.4.3 Restoration of Quarry and Road Close-out

The road access to the dam would no longer be necessary once lagoon restoration is complete. The road within 200 yards of the dam would be removed by recountouring the area (Figure 9). The quarry would be scarified and recontoured using a bulldozer and excavator. Material excavated from the dam would be compacted at the quarry site and recontoured to surrounding slope conditions. Fill would be placed using eight-inch lifts and compacted with the tracks of the bulldozer. A water truck may be required to meet compaction requirements.

Additional material would be compacted on the inboard side of the roadbed using the bulldozer. Finish work would be conducted by an excavator. The fill portion of the road prism would be excavated and spread over the top of the newly placed road fill. Topsoil recovered from the dam area and the road side cast would be spread over the newly recontoured area. The topsoiling is intended to inoculate the treated area with locally derived seeded soils.

Erosion control on the regraded sites would include actions to break up and prevent the formation of long flow paths. Regrading actions would leave some roughness in the soil and bio-logs or similar treatments would be installed at contour to detain concentrated flow. Natural revegetation of the site would be augmented with shrubs recovered from the removal areas. The area would be monitored for growth of invasive non-native plant species. Such species would be targeted for removal.

2.4.4 Attainment of Project Objectives

This alternative attains all project objectives described under Purpose and Need to the fullest extent.

2.5 ALTERNATIVES CONSIDERED BUT DISMISSED

2.5.1 Full removal of the dam structure

The NPS considered full removal of the dam fill with the intent of complete shoreline restoration at the site. Early in the planning process, it was determined that an archaeological site was located in the vicinity of the dam facility. Through further investigation, the extent of the site has been documented, and the design has been developed to avoid any potential impact to the archaeological resources. This alternative has been dismissed because it could significantly and adversely impact the documented archaeological resources in the project area.

2.6 ENVIRONMENTALLY PREFERRED ALTERNATIVE

The environmentally preferred alternative is the alternative that will promote the national environmental policy expressed in NEPA (sec 101 (b)). It is the alternative that would cause the least damage to the biological and physical environment and best protects, preserves, and enhances historic, cultural, and natural resources.

The project alternatives represent a range of treatment actions intended to protect and enhance the cultural and natural resources documented within the project area. The current degraded state of water quality limits the ecological productivity and stability of the system and would be continued under Alternative A. While this alternative would not result in direct impacts to resources, ongoing degraded conditions are not environmentally desirable for this area.

Under Alternative B, only the removal of the cement spillway and associated fill is proposed. While this would enhance the aesthetics of the site, it would not treat the long-term constraint on water quality, hydrologic function or shoreline process. In the long term (~50 years) erosion and decay of the facility may allow for a more ecologically stable and suitable system. In general, despite the proposed treatment, the conditions within the main body of Horseshoe Pond would remain similar to conditions without any direct treatment. Restoration of the former waste lagoon (proposed for both Alternative B and C) would be beneficial to the local park resources. While direct impacts to Horseshoe Pond area would be limited, ongoing degraded conditions are not environmentally desirable for this area.

The NPS has selected Alternative C as the environmentally preferred alternative. Alternative C sets the stage for the recovery of this long-degraded and constrained aquatic resource by restoring natural process through the removal of the constructed dam facility at Horseshoe Pond, as well as enhancement activities at the former waste lagoon. While this alternative would include the most direct short-term impacts, it would facilitate natural process providing for the long-term development of an ecologically sustainable and functional system. In addition, this alternative would avoids impacts to cultural resources (CA-MRN-394/H) and would likely reduce current erosion pressures at the site. Alternative C would require the least maintenance in the future and would provide the widest range in beneficial uses to this area of national trust lands. Alternative C also provides more aesthetic enhancement and restoration than Alternative B. Alternative C reforms the engineered levees of Horseshoe Pond to be more compatible with the existing natural contours around the pound and removes more debris from the Project Area. Despite increased potential short-term impacts, Alternative C would facilitate the development of a more ecologically stable system that meets the NPS management policies related to natural shoreline and hydrologic process.

2.7 ENVIRONMENTAL COMMITMENTS

Environmental commitments are measures and practices that will be implemented as standard procedures during the project to reduce or avoid adverse impacts resources within the project area. The NPS is committed to ensuring that all actions proceed in the most environmentally sensitive manner possible. Consequently, a number of environmental commitments have been adopted for the proposed action, and will be incorporated into construction activities. The following sections describe the environmental commitments that will be implemented for the proposed action.

The measures identified below apply to all build alternatives associated with the project.

2.7.1 Erosion and Sediment Control Measures

- All conduct construction activities during the dry season.
- All construction work will be conducted in accordance with site-specific construction specifications that minimize the potential for increased delivery of sediment to surface waters.
- Minimize removal of and damage to native vegetation.
- Install temporary construction fencing to identify all areas that require clearing, grading, revegetation, or recontouring, and minimize the extent of areas to be cleared, graded, recontoured, or otherwise disturbed.
- As appropriate, implement erosion control measures to prevent sediment from entering surface waters, including the use of silt fencing or fiber rolls to trap sediments and erosion control blankets on slopes and channel banks.
- Avoid operating equipment in flowing water by using temporary cofferdams and/or other suitable materials to divert flow around the channel and bank construction area.

2.7.2 Spill Prevention and Response Plan

NPS will require the construction contractor to prepare a spill prevention and response plan that regulates the use of hazardous and toxic materials, such as fuels and lubricants for construction equipment. NPS will oversee implementation of the spill prevention and response plan. Elements of the plan will ensure that:

- workers are trained to avoid and manage spills;
- construction and maintenance materials are prevented from entering surface waters and groundwater;
- all spills are cleaned up immediately and appropriate agencies are notified of any spills and of the cleanup procedures employed;
- staging and storage areas for equipment, materials, fuels, lubricants, solvents, and other possible contaminants are located at least 100 feet away from surface waters;
- no vehicles are fueled, lubricated, or otherwise serviced within the normal high-water area of any surface water body;
- vehicles are immediately removed from work areas if they are leaking; and
- no equipment is operated in flowing water (suitable temporary structures are installed to divert water around in-channel work areas).

2.7.3 Measures to protect cultural resources

The NPS will coordinate with the Federated Indians of Graton Rancheria to insure that either an NPS or FIGR representative is on site during the construction activities. While the project has been designed to remain away from documented resource areas, the NPS employee will be on site to insure that this is indeed the case. In the case that resources are discovered during the course of construction, the NPS will

act immediately and appropriately as documented in 36 CFR 800.13 "Post-review discoveries" (http://www.achp.gov/regs.html#800.13). Based on the amount of exploratory work conducted as part of this planning process, the chances are likely very low that the project will encounter any resources of concern.

2.7.4 Measures to Protect Recreational Use

NPS will take feasible measures to minimize the effects of project construction on recreational use. Information on upcoming closures, including closure dates and arrangements for alternative parking, restroom facilities, and trail access points will be posted on the park website, distributed at the Bear Valley and Ken Patrick Visitor Centers, and posted at each construction site.

2.7.5 Measures to Protect Plant Life

Measures to protect riparian, tidal marsh, coastal vegetation and special status plants during construction will be incorporated into construction activities. They will include, but may not be limited to, the following.

- Temporary construction fencing will delimit work areas. Fencing will be installed before any site preparation work or earthwork begins.
- Exclude foot and vehicle traffic from sensitive areas using temporary construction fencing and flagging tape in a conspicuous color.
- The project site will be surveyed for pink sand verbena prior to construction actions and flagging placed to mark any locations. During construction, the area will be fenced off to protect against disturbance. In areas where the plant is known to occur, but is not present at the time of survey, the surface sand layer would be stockpiled and spread to nearby areas following construction, allowing for natural regeneration of pink sand verbena from seed the following season.

2.7.6 Measures to Protect Wildlife

To prevent disturbance of migratory birds—protected under the federal Migratory Bird Treaty Act, the California Fish and Game Code, and CEQA—no project-related activities will take place during the migratory bird nesting season (March 15–July 31). Project activities, including site preparation, equipment and materials staging, etc., will not begin until August 1 unless a survey is conducted by a qualified biologist at the project site and no nesting activity is identified. The survey for nesting activity must be conducted within one week of the start of project activities.

2.7.7 Measures for Aquatic and Amphibian Species

Before dewatering activities begin at any site, NPS will ensure that all native aquatic vertebrates and larger invertebrates are relocated to a flowing channel segment by a qualified fisheries biologist. NPS will work with NOAA Fisheries and CDFG to identify or develop the most appropriate relocation protocol. Construction activities will be prohibited from unnecessarily disturbing aquatic habitat.
To ensure against adverse impacts on California red-legged frog (*Rana aurora draytonii*), NPS will conduct preconstruction clearance surveys for this species and establish. A silt fence will be installed on the pond side to exclude frogs from the project area. The construction will occur during a period of time when frog use of the pond is likely low. A biologist will survey the construction area on a daily basis to insure that frogs or other species have not moved in during the night.

2.8 MATRIX SUMMARIZING THE IMPACTS OF ALTERNATIVES

Impact Topic	Alternative A	Alternative B	Alternative C
Geology and Soils	Alternative A would not meet the project objectives described in the Purpose and Need Chapter. The park was established by Congress to preserve and protect the diminishing coastline of the United States. Alternative A would maintain conditions that support continued erosion of road and dam facilities within the project area. The continued degradation is inconsistent with NPS management policies and project objectives. Alternative A would result in long-term, minor, adverse impacts to the estuarine condition in the project area from the continued erosion.	Under Alternative B, minor, long-term, beneficial impacts to soils and topography would result from removal of the spillway and regrading activities of the enhancement pond area. No actions would occur on the eroding road, quarry, or dam facilities. As the project area is located within and contributes to a highly altered landscape and altered soil conditions, no impairment of soil resources would occur.	Under Alternative C, minor adverse short-term, impacts to soils and topography would result from removal of the spillway and dam sections, recontouring and revegetation of the quarry and access road areas, and regrading activities of the enhancement pond area. The actions proposed under Alternative C would result in long-term beneficial impacts to soils and topography within the project area and would not result in an impairment of park resources or values.

Water Resources and Shoreline Process	Alternative A would not meet the project objectives described in the Purpose and Need Chapter. The physical restrictions associated with the east-valley outlet would limit the ecological recovery of this estuarine/lagoonal system. The configuration and controls associated with the outlet restrict hydrologic process and the ability of the lagoon to function in a balanced state. The lagoon system evolved and functioned at a dynamic equilibrium until the dam was constructed. Despite the return of limited tidal interaction, the ability of the system to return to physical and ecological equilibrium is highly restricted. Because of these physical limitations, the water quality and estuarine conditions would remain degraded for a long period of time (>50 years). The capacity of the area to recover ecologically is directly linked to the presence of and time for a dynamic hydrologic equilibrium to return. Alternative A would likely result in long-term water quality conditions that prevent establishment of stable fish populations and limit macroinvertebrate productivity and thus, bird use. As a result, Alternative A would result in long-term (~50 years), moderate, adverse impacts to water resources, water quality and shoreline process. As the management trajectory associated with Alternative A would not preclude the eventual restoration of dynamic equilibrium in the future, and the impact is restricted in effect, Alternative A would not result in an impairment of park resources.	Alternative B would partially meet one objective described in the project Purpose and Need -- to return the pond vicinity to a more natural appearing state by removing prominent evidence of construction (e.g. cement spillway feature and limited fill). The physical restrictions associated with the east-valley outlet would limit the ecological recovery of this estuarine/lagoonal system. The actions proposed under Alternative B would remove the cement structure, but not otherwise change the hydrologic conditions at Horseshoe Pond described under Alternative A. The configuration and controls associated with the outlet restrict hydrologic process and the ability of the lagoon to function in a balanced state would remain as they would under Alternative A. Because of these physical limitations, the water quality and estuarine conditions would remain degraded for a long period of time (>50 years). The capacity of the area to recover ecologically is directly linked to the presence of and time for a dynamic hydrologic equilibrium to return. The continuation of limited hydrologic function, degraded marine and estuarine resources, and degraded water quality conditions within the project would result in long-term, moderate adverse impacts to hydrology and water resources under Alternative B. The enhancement activities proposed at the former D-Ranch waste lagoon would result in short-term, minor adverse impacts to the impacts, but the activities would result in beneficial long-term impacts to the site through facilitation of a healthy aquatic ecosystem at this site. Removal of the cement facilities would improve the site aesthetics, but would not dramatically alter the long, slow trend towards recovery. Because the management trajectory associated with Alternative B would not prevent the development of dynamic equilibrium over time and Alternative B includes the enhancement site to enhance freshwater aquatic habitat for the California red-legged frog, this alternative does not result in impairment of water resources. Work conducted under this alternative would require Clean Water Act Section 401 certification from the Regional Water Quality Control Board for water quality related issues.	The actions proposed under Alternative C would meet all of the objectives described in the project Purpose and Need by restoring circulation patterns to what they were prior to impoundment of the lagoon. Changes would include increased tidal influence and circulation in the winter, and reduced fluctuations in salinity and dissolved oxygen levels in the summer. Shoreline process and watershed runoff would likely reach dynamic equilibrium in 1-5 years. Restoration of hydrologic flow patterns and shoreline process would reduce erosion potential to cultural resource site CA-MRN-394/H and would accelerate the return of the system to a state of functional dynamic equilibrium. The actions proposed under Alternative C would result in short-term, minor adverse impacts to water quality and estuarine resources as the system adjusts and stabilizes under a new hydrologic regime. This would be balanced by long-term beneficial impacts as the system meets dynamic equilibrium in a time period far shorter than what is expected under either Alternatives A or B. The enhancement activities proposed at the former D-Ranch waste lagoon, road cut and quarry would result in short-term minor impacts to those sites and minor long-term beneficial impacts and facilitation of a healthy aquatic ecosystem at this site. Alternative C would remove structures that impede natural process and restrict return to dynamic hydrologic equilibrium. Consistent with NPS Management Policies, restoration actions proposed under this alternative address wetland, water quality and estuarine/lagoon degradation, as well as restoration of natural shoreline and hydrologic process to the area. This alternative would not result in impairment of water resources. Work conducted under this alternative would require Clean Water Act Section 401 certification from the Regional Water Quality Control Board for water quality related issues.

Impact Topic	Alternative A	Alternative B	Alternative C
Cultural Resources	Under Alternative A, the continued erosion of the documented site would result in moderate, long-term adverse impact to the cultural resources. The erosive processes are related to the existing hydrologic flow configurations, and would remain a persistent problem at this location. Under Alternative A, the site would likely continue to erode and would therefore not meet the project objective : to protect stability of archaeological resource site CA-MRN-394/H. As Alternative A would not change the current condition of site CA-MRN-394/H, the alternative would not result in an impairment of park resources.	Under Alternative B, actions to remove the cement dam and fill would avoid, and therefore not impact archaeological resources at the site. However, the continued erosion and potential loss of the documented site would result in a minor, long-term adverse impact to cultural resources at PRNS. The erosive processes are related to the existing hydrologic flow configurations, and would remain a persistent problem at this location. This alternative would not meet the project objective to protect stability of archaeological resource site CA-MRN-394/H. Despite avoiding direct impact to known cultural resource sites, maintenance of the current hydrologic configuration would not protect the stability of the site. As Alternative B does not propose actions that would accelerate degradation or change current condition of site CA-MRN-394/H, it would not result in an impairment of park resources. The potential loss of the site due to erosion would not be considered an "impairment" (NPS 2001a) No cultural resources are identified at the Enhancement Site and treatment would not effect known cultural resources.	The actions proposed under Alternative C would avoid areas identified as culturally significant, and therefore would not result in direct impacts to cultural resources within the project area. The restoration of historic configuration to the western side of the valley would provide for natural shoreline process. There is clear evidence that the western outlet was the primary outlet for more than 500 years, and it is likely that coastal circulation patterns would maintain this condition naturally. The restoration actions described under Alternative C would avoid direct impacts and would result in long-term beneficial impacts to the known cultural resources or an impairment of cultural resources or values. No cultural resources are identified at the Enhancement Site, road cut or quarry sites. Treatment would not affect known cultural resources in this area.
Vegetation	Under Alternative A, long-term, minor adverse impacts to native vegetation would continue due to the presence of non-native, invasive plants at the project site. An impairment of park resources or values associated with vegetation would not result from Alternative A.	The actions proposed under Alternative B would result in minor short-term and beneficial long-term impacts on vegetation within the project area due to rehabilitation of the CRLF Enhancement Site. No impairment of vegetation resources or values would result.	The actions proposed under Alternative C would have negligible, short-term and beneficial long-term impacts on vegetation within the project area. Because of the small area of impact and plans for replanting vegetation in the restored areas, Alternative C would not result in impairment of park resources or values related to vegetation.
Wetlands	No impacts to wetlands or impairment of park wetland resources would occur under Alternative A.	The actions proposed would result in direct impacts leading to areal expansion of US Army Corps jurisdictional tidal waters, tidal wetlands, isolated waters and isolated wetlands. In addition, the actions proposed under this alternative would result in expansion of estuarine intertidal emergent and unconsolidated bottom wetland types in the spillway area, and likely conversion and addition of palustrine emergent flooded and seasonally flooded wetland resources in the enhancement area. This Alternative would result in minor adverse short-term impact following construction and minor beneficial long-term impact on wetland habitat within the project area. Based on this assessment, Alternative B would not result in impairment of park resources or values related to wetlands. Work conducted under this alternative would require permits from the US Army Corps (Clean Water Act Section 404) and a coastal consistency determination/Coastal Permit from the California Coastal Commission for work in the wetland resource areas.	The actions proposed under Alternative C would result in minor short-term adverse impacts, but beneficial long-term impact to wetland habitat within the project area. The net expansion of wetlands by up to one acre through the removal of fill at the spillway and western dam facility, and recontouring and enhancement of the CRLF site would result in long-term beneficial impacts to the project area. The actions proposed under Alternative C would result in the net expansion of wetlands. Changes in water regime and source of water (from freshwater to saline water) would result in the conversion of some wetland types within the project area. In the interim, the wetland resources would adjust and change, primarily with the changes in tidal circulation and shoreline process. Alternative C would not result in impairment of park resources or values related to wetlands.

Impact Topic	Alternative A	Alternative B	Alternative C
Special Status Species			
Amphibians	The current conditions at Horseshoe Pond would continue under Alternative A. No enhancement actions would be conducted at any other site to augment habitat availability in this area. For these reasons, Alternative A would result in minor, long-term, adverse impacts to the California red-legged frog, federally-listed as a threatened species under the Endangered Species Act. Horseshoe Pond represents one of 120 known breeding areas in the park, and the pond would continue to provide the existing quality of breeding and foraging area. While observed frog numbers have declined, there is still use of the area for breeding. Because this is not the only site in the park supporting the CRLF, and there is known breeding in other adjacent areas, Alternative A would not result in impairment of park resources or values associated with amphibians protected under the Endangered Species Act.	Alternative B would not dramatically change hydrologic conditions or effects to the CRLF within Horseshoe Pond beyond those described under Alternative A. Within Horseshoe Pond, Alternative B would result in moderate, long-term, adverse impacts to the California red-legged frog, federally-listed as a threatened species under the Endangered Species Act. Alternative B does provide additional enhancement habitat for the CRLF through the restoration of a former waste lagoon near the D-Ranch Complex. This would enhance more than an acre of aquatic habitat that may be used by the CRLF, adjacent to the existing habitat. Activities conducted at the Enhancement Site would result in moderate short-term impacts, but beneficial long-term impacts to special status amphibians. Horseshoe Pond is one of 125 known breeding areas in the national park. Under Alternative B, the pond would continue to provide the existing quality of breeding and foraging area and a former waste lagoon would be improved to provide habitat for the CRLF. As a result, Alternative B would not result in impairment of park resources or values associated with species listed under the Endangered Species Act.	Alternative C would not dramatically change hydrologic conditions or effects to the CRLF beyond those described under Alternative A or B. Because conditions may change to some degree, but the area would still likely support breeding habitat for the frogs, it is determined that Alternative C would result in minor, long-term, adverse impacts to the California red-legged frog and associated breeding habitat at Horseshoe Pond. Alternative C does provide additional enhancement habitat for the CRLF through the restoration of a former waste lagoon near the D-Ranch Complex. This would add another breeding habitat, including more than one acre of aquatic habitat that may be used by the CRLF, adjacent to the existing habitat. Improvements proposed for the Enhancement Site would result in minor, beneficial long-term impacts to special status amphibians. Horseshoe Pond represents one of more than 120 known breeding areas in the park, and the pond would continue to provide the existing quality of breeding and foraging area. In addition, Alternative C includes the enhancement of a former waste lagoon to support critical habitat for the CRLF. Alternative C would not result in impairment of park resources or values associated with species listed under the Endangered Species Act.
Plants	Alternative A would have no direct effect on special status plant species within the project area but continued spread of European beach grass within Point Reyes National Seashore could eventually displace the dune habitat supporting special status plants. Alternative A would have a minor, long-term adverse effect on special status plant species but would not constitute an impairment of park resources.	Spillway removal activities would avoid direct impacts to sensitive plant locations; Alternative B would not affect special status plants occurring within the project area or result in an impairment of park resources. Habitat for western pond turtle could be expanded with the addition of the Enhancement Site.	The activities conducted under Alternative C would avoid direct impacts to known special status plant species within the area. Park staff would fence out areas supporting these species to avoid disturbance. It is possible that through restoration of the historic outlet and shoreline process, the area supporting pink sand verbena may actually expand. Soil adjacent to growing areas which could contain seed would be stockpiled and reapplied to the area at the end of the restoration activities. Alternative C could result in minor, long-term beneficial impacts effects to special status plant species and would not result in an impairment of park resources associated with special status plant species.

Other SSP	Alternative A would have no effect on other special status species within the project area and no impairment of park resources could result.	Alternative B would result in negligible short-term impacts and beneficial long-term impacts on special status species within the project area and would not result in an impairment of park resources or values.	Restoration of natural shoreline and hydrologic process would have benefits to water quality and food supply that could benefit multiple bird species known to use the project area. Actions under Alternative C could facilitate development of habitat that could support an experimental tidewater goby reintroduction. Alternative C would result in beneficial long-term impacts on special status species within the project area and would not impair park resources associated with special status species.

3.0 PROJECT SETTING AND AFFECTED ENVIRONMENT

Despite its alterations, Horseshoe Pond and its surrounding watershed contain important biological, physical, and cultural resources meriting evaluation under the three restoration alternatives. This chapter provides an understanding of both the general environmental setting of the project area and a more focused description of those specific resources that could be affected by the proposed project. The first section, Project Setting, is presented to foster a fuller understanding of the Project Area (see Figure 6). The Affected Environment is required (by the NEPA regulations [Section 1502.15]) to provide a description of the specific resources that could be affected, directly or indirectly, by project implementation. Information provided in this chapter was gathered from literature reviews; the compilation of existing data, and primary field surveys conducted to inventory and evaluate current environmental conditions within the Project Area.

3.1 PROJECT SETTING

3.1.1 Environmental History

The Project Area is within the historic D-Ranch complex built between 1862 and 1871. The Ranch became part of Charles W. Howard's holdings through the Shafters/Howard Partition of 1867-70 (Livingston 1995). The Shafters/Howard Partition divided parcels on the Point Reyes Peninsula between Oscar L. Shafter, James M. Shafter, and Howard. After changing ownership several times, Bill and Alice Hall bought the ranch in 1940 after living at the complex and leasing the property from owner Quinto Condoni since 1936. The Halls sold the dairy business to son and daughter Vivian and Bill, Jr. in the late 1940's, although it was Vivian and husband Rudolph Horick who operated the dairy from about 1964 on. In 1971, the Point Reyes National Seashore purchased the ranch and established a 20-year lease and occupancy reservation agreement with the Hall/Horick Family. Upon Mr. Horick's passing in 1980, Mrs. Horick became the sole ranch operator until her death in 1998. At the time of her death, the ranch was operating under a second, renewed five-year special use permit (SUP) that expired in 2001. The NPS was unable to reach an agreement on the future of the ranch with the Horick family and subsequently terminated the SUP, resulting in closure of the dairy facility.

Areal photos from 1941 and 1943 reveal that the historic outflow of Horseshoe Pond was in the southwest corner of the pond, opposite the current channel to Drakes' Beach (Figure 2). Visible in these photographs is a broad, sandy channel set against the west slope of the drainage and a large plume of sand extending far into the pond from the channel opening. In these historic photos, the current channel on the west side of the pond appears to be dominated on the exterior by dune vegetation and on the interior by wetland vegetation. The 1941 photograph, taken in December, shows a small pond set just behind the dune. The pond and wetland vegetation suggest that the eastern area remained rather stable through time.

In late 1940s, the Hall/Horick Family built a road leading downslope from the ranch complex, across the front of Horseshoe Pond, and up a side drainage to reach the east pastures and a hunting cabin on the shore of Drakes' Estero (Figure 3). This road effectively cut off regular tidal exchange with Drakes' Bay. A bridge/culvert complex was developed to allow pond overflow onto the beach through the historic outflow channel, but the remainder of the historic channel was filled with material quarried from just behind the cliff, along Drakes' Beach. Additional fill was laid along the entire dune barrier to the east side of the pond.

By 1974, the pond had reached its current water level and the historic channel had almost completely filled with vegetation, presumably the same complex of saltgrass (*Distichilis spicata*) and rushes (*Juncus sp*.) present today. At some point prior to 1974, the culvert/bridge system was removed, perhaps due to failure, and the earthen berm was sealed up completely with additional material from the quarry. The earthen dam existed in this state until the early 1980s. Storm events and high water levels in the pond began eroding the road and berm near the current outflow channel of the pond, so that by 1983 a large portion of the dam had been lost and the remaining road up to the east pastures overlooking Drakes' Estero was only passable at low water. Severe storms and coupled with high tides in January 1982 may have accelerated this process.

In 1988, the Horick Family received funding from the Natural Resource Conservation Service's (NRCS) Agricultural Conservation Program to construct an alternate route to the east pastures (Figure 4). The existing 60 foot concrete spillway was built across the outflow of the pond in the eastern corner of the pond and reinforced with rip-rap. To allow vehicle passage, fill was taken from the adjacent slope and laid down on either side of the spillway, once again sealing off the pond to tidal exchange.

Water quality conditions in Horseshoe Pond have degraded severely during its 50-year existence. Dairy cows had direct access to Horseshoe Pond for decades, using the site both as a "loafing area" and for drinking water (Figure 5). For years, liquid dairy waste was discharged downhill from behind the dairy barns to a small holding pond at the head of the west arm of Horseshoe Pond. In a letter to the PRNS Superintendent dated January 1988, the Sierra Club Marin Chapter expressed concern that "rotting manure carpeted" much of the Horseshoe Pond flood plain below the holding pond and that water flowing down from the ranch complex appeared yellow. A 1990 draft Ranch Unit Plan prepared by an NPS Range Conservationist stated that "the manure stream has overflowed this holding pond and streamed directly into Horseshoe Pond like a viscous lava flow." The Plan noted that Horseshoe Pond "served as an ultimate sewage lagoon for the dairy for many years."

The SUP under which the D Ranch operated was not continued after the death of the permittee. All dairy cows were removed from the Project Area and the surrounding watershed. Under a new SUP, some watershed lands are being used for beef cattle grazing. The earthen dam and concrete spillway remain in place, though a 15-ft section of material adjacent to the concrete spillway washed out in January 2002. Ocean water now flows into Horseshoe Pond through a constricted opening on extreme high tide and storm events.

3.1.2. Wildlife Use of the Project Site

3.1.2.1. Fish Species Commonly Found

PRNS staff conducted preliminary fish surveys at Horseshoe Pond in June and July 2001. Traps deployed in all habitats collected large numbers of three-spine stickleback (*Gasterosteus aculeatus*) – over 200 fish on average. No other fish species were collected in the minnow traps. The gill net was set overnight on two occasions. Although, the gill net is designed to capture fish in a range of different sizes, no fish were captured on both sets. These results are consistent with fish sampling conducted by the U.S. Geological Survey – Biological Resources Division (USGS-BRD) in nearby Abbotts Lagoon (Saiki 2000). USGS-BRD biologists successfully collected three-spine stickleback in minnow traps, but did not capture any with gill nets.

The concrete spillway has proved to be effective in blocking upstream migration of fish from Drakes Bay into Horseshoe Pond. During the red tide event in May 2001, PRNS staff observed up to one dozen prickly and staghorn sculpin either dead or dying in the shallows of the channel water due to anaerobic water conditions. Caught between the concrete spillway and the beach, these fish were unable to escape to more hospitable environments.

However, recent loss of a portion of the earthen berm flanking the concrete spillway in January 2002 has temporarily alleviated movement restrictions between Drakes Bay and Horseshoe Pond. Minnow traps deployed in Horseshoe Pond on January 13, twelve days following the spillway failure, successfully captured a staghorn sculpin (*Leptocottus armatus*) previously only known to occur on the oceanside of the spillway. In addition, USGS biologists conducting California red-legged frog surveys in February 2002 found a dead topsmelt (*Atherinops affinis*) floating in Horseshoe Pond.

Horseshoe Pond held a depleted fish community because of poor water quality conditions and a migration barrier from Drakes Bay. Currently, however, water levels may be the most limiting factor controlling the fish community. Drying of the pond in late summer 2002 effectively eliminated fish from Horseshoe Pond.

3.1.2.2 Bird Species Commonly Found

A total of 18 waterfowl and shorebird surveys were conducted at Horseshoe Pond between April 2001 and October 2002. Since no one vantage point allows for full, unobstructed views of the pond, surveys were completed by canoe or by walking the perimeter of the pond in order to document all waterfowl and shorebirds present.

Shorebird presence was correlated with pond water level and migration patterns, with the highest numbers occurring in August and September. Although October-March is the time of greatest shorebird abundance at Point Reyes (Evens 1988), few shorebirds were observed at Horseshoe Pond in the winter and spring months, perhaps because flooded shoreline mudflats at high water levels lessened the availability of shorebird foraging habitat. Shorebird abundance was highest on surveys completed between mid-August and mid-September 2002 when the pond levels were at their lowest and available foraging habitat was greatest. By mid-October, however, when the pond had dried up, few to no shorebirds could be found at Horseshoe Pond. Notable shorebirds observed at Horseshoe Pond included Baird's Sandpiper (*Calidris bairdii*), Pectoral Sandpiper (*Calidris melanotus*), Greater Yellowlegs (*Tringa melanoleuca*), Lesser Yellowlegs (*Tringa flavipes*), Spotted Sandpiper (*Actitis macularia*), and Wilson's Phalarope (*Phalaropus tricolor*).

The highest waterfowl counts occurred in late-summer and fall. Mallards and gadwall are year round residents at Horseshoe Pond. Both species have been observed with ducklings during the summer months. Waterfowl numbers were inflated at the pond in August and September by migratory influxes of Green-winged Teal, Northern Pintail, American Wigeon, and additional Mallards. In late summer 2002, however, low water levels reduced waterfowl numbers considerably, and no waterfowl occurred at Horseshoe Pond from mid-September until the pond began to fill with the first rain storms in November.

Additional bird count points were established within the Project Area to document terrestrial bird activity within the construction footprint. Terrestrial birds observed within the Project Area were typical of coastal dune, grassland, and scrub habitats.

Bird data from Park Service surveys are summarized in Tables 2-4. Bird lists are provided for two areas within the Project Area – the pond itself, surveys points along the dam and road in front of the pond, and at the Enhancement Site. Abundance ratings for bird species are based on the frequency of sitings and only reflect the areas and time intervals surveyed. Breeding status is based on direct observations of courting behavior, nesting behavior, or presence of juveniles.

During the winter of 1997-98, the Point Reyes Bird Observatory (PRBO) conducted an inventory of wintering waterbirds and shorebirds at several sites in the PRNS and the Golden Gate National Recreation Area, including Horseshoe Pond (Page and White 1999). Table 5 summarizes the results of six surveys conducted by PRBO between November 1998 and March 1999. The composition of waterbird and shorebird species is comparable to that observed in Park Service surveys. A comparison of these data sets reveals a marked decline in ruddy duck and American coot abundance at Horseshoe Pond since the PRBO surveys.

Rich Stallcup has compiled additional bird data over the last 25 years of regular birding excursions to Horseshoe Pond. Because of the brevity of Park Service surveys compared to surveys conducted by Stallcup, his data is presented in this EA as Table 6. Stallcup has documented several shorebird and waterfowl species at Horseshoe Pond that were not observed during the course of Park Service surveys. For some species, Stallcup reports higher numbers of individuals observed at one time.

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Table 2. List of bird species observed at Horseshoe Pond by PRNS biologists.

Common Name	Scientific Name	Occurrence*	Breeding^	Max Count
Horned Grebe	*Podiceps auritus*	Occasional		1
American White Pelican	*Pelecanus erythrorhynchos*	Seasonally Regular		86
Brown Pelican	*Pelecanus occidentalis*	Occasional		2
Double-crested Cormorant	*Phalacrocorax auritus*	Seasonally Regular		3
Great Blue Heron	*Ardea herodias*	Year-round Regular		1
Black-crowned Night-Heron	*Nycticorax nycticorax*	Rare		1
Great Egret	*Casmerodius albus*	Year-round Regular		3
Canada Goose	*Branta canadensis*	Rare		2
Green-winged Teal	*Anas crecca*	Seasonally Regular		28
Cinnamon Teal	*Anas cyanoptera*	Occasional		10
Northern Shoveler	*Anas clypeata*	Seasonally Regular		47
Mallard	*Anas platyrhynchos*	Year-round Regular	Yes	137
Northern Pintail	*Anas acuta*	Seasonally Regular		64
Gadwall	*Anas strepera*	Year-round Regular	Yes	101
American Wigeon	*Anas americana*	Seasonally Regular		5
Canvasback	*Aythya valisineria*	Seasonally Regular		43
Common Goldeneye	*Bucephala clangula*	Occasional		1
Bufflehead	*Bucephala albeola*	Seasonally Regular		9
Ruddy Duck	*Oxyura jamaicensis*	Seasonally Regular		37
Peregrine Falcon	*Falco peregrinus*	Seasonally Regular		2
Killdeer	*Charadrius vociferus*	Year-round Regular		3
Greater Yellowlegs	*Tringa melanoleuca*	Seasonally Regular		3
Lesser Yellowlegs	*Tringa flavipes*	Seasonally Regular		2
Willet	*Catoptrophorus semipalmatus*	Seasonally Regular		2
Marbled Godwit	*Limosa fedoa*	Seasonally Regular		17
Western Sandpiper	*Calidris mauri*	Seasonally Regular		39
Least Sandpiper	*Calidris minutilla*	Seasonally Regular		15
Baird's Sandpiper	*Calidris bairdii*	Seasonally Regular		1
Pectoral Sandpiper	*Calidris melanotos*	Seasonally Regular		4
Dowitcher sp.	*Limnodromus sp.*	Seasonally Regular		134
Wilson's Phalarope	*Phalaropus tricolor*	Rare		2
Red-necked Phalarope	*Phalaropus lobatus*	Seasonally Regular		230
Gull	*Larus sp.*	Year-round Regular		9
Caspian Tern	*Sterna caspia*	Seasonally Regular		8
Belted Kingfisher	*Ceryle alcyon*	Occasional		2
Marsh Wren	*Cistothorus palustris*	Year-round Regular	Yes	2
American Pipet	*Anthus rubescens*	Rare		1

*Occurrence Ratings

Year-round regular: predictably observed at Horseshoe Pond.

Seasonally regular: predictably observed at Horseshoe Pond during certain times of year.

Occasional: infrequently observed at Horseshoe Pond.

Rare: occurrence based on one sighting only at Horseshoe Pond.

^Breeding Status – based on direct observations of courting behavior, nesting behavior, or presence of juveniles.

Table 3. List of bird species observed at the Horseshoe Pond spillway, earthen berm, and quarry observation points by PRNS biologists.

Common Name	Scientific Name	Occurrence*	Breeding^	Max Count
Mallard	Anas platyrhynchos	Year-round Regular	Yes	2
Gadwall	*Anas strepera*	Year-round Regular	Yes	2
Turkey Vulture	*Cathartes aura*	Year-round Regular		4
Osprey	*Pandion haliaetus*	Occasional		1
Northern Harrier	*Circus cyaneus*	Year-round Regular		1
California Quail	*Callipepla californica*	Year-round Regular	Yes	13
Anna's Hummingbird	*Calypte anna*	Seasonally Regular		1
Northern Flicker	*Colaptes auratus*	Occasional		1
Tree Swallow	*Tachycineta bicolor*	Seasonally Regular		60
Cliff Swallow	*Hirundo pyrrhonota*	Occasional		4
Barn Swallow	*Hirundo rustica*	Occasional		2
Common Raven	*Corvus corax*	Year-round Regular		1
Swainson's Thrush	*Catharus ustulatus*	Seasonally Regular	Yes	1
Wrentit	*Chamaea fasciata*	Year-round Regular	Yes	1
Wilson's Warbler	*Wilsonia pusilla*	Seasonally Regular	Yes	3
Grasshopper Sparrow	*Ammodramus savannarum*	Occasional		1
Song Sparrow	*Melospiza melodia*	Year-round Regular	Yes	10
White-crowned Sparrow	*Zonotrichia leucophrys*	Year-round Regular	Yes	3
Brown-headed Cowbird	*Molothrus ater*	Year-round Regular	Yes	6
American Goldfinch	*Carduelis tristis*	Seasonally Regular	Yes	5
European Starling	*Sturnus vulgaris*	Rare		1

*Occurrence Ratings

Year-round regular: predictably observed at observation points.

Seasonally regular: predictably observed at observation points during certain times of year.

Occasional: infrequently observed at observation points.

Rare: occurrence based on one sighting only at observation points.

^Breeding Status – based on direct observations of courting behavior, nesting behavior, or presence of juveniles.

Table 4. List of bird species observed at the California red-legged frog enhancement site by PRNS biologists.

Common Name	Scientific Name	Occurrence	Breeding^	Max Count
Mallard	*Anas platyrhynchos*	Year-round Regular	Yes	13
Gadwall	*Anas strepera*	Occasional		2
Turkey Vulture	*Cathartes aura*	Year-round Regular		1
Northern Harrier	*Circus cyaneus*	Year-round Regular		1
Anna's Hummingbird	*Calypte anna*	Seasonally Regular		1
Barn Swallow	*Hirundo rustica*	Occasional		5
Common Raven	*Corvus corax*	Year-round Regular		2
Wrentit	*Chamaea fasciata*	Year-round Regular	Yes	1
Song Sparrow	*Melospiza melodia*	Year-round Regular	Yes	18
White-crowned Sparrow	*Zonotrichia leucophrys*	Year-round Regular	Yes	11
Red-winged Blackbird	*Agelaius phoeniceus*	Year-round Regular	Yes	5
Brewer's Blackbird	*Euphagus cyanocephalus*	Year-round Regular		4
Brown-headed Cowbird	*Molothrus ater*	Year-round Regular	Yes	4
American Goldfinch	*Carduelis tristis*	Seasonally Regular	Yes	3
European Starling	*Sturnus vulgaris*	Rare		6

*Occurrence Ratings

Year-round regular: predictably observed at observation points.

Seasonally regular: predictably observed at observation points during certain times of year.

Occasional: infrequently observed at observation points.

Rare: occurrence based on one sighting only at observation points.

^Breeding Status – based on direct observations of courting behavior, nesting behavior, or presence of juveniles.

Table 5. Point Reyes Bird Observatory inventory of wintering waterbirds and shorebirds at Horseshoe Pond.

Common Name	Scientific Name	11/10/1998	12/8/1998	1/5/1999	1/21/1999	2/3/1999	3/3/1999
Horned Grebe	Podiceps auritus					4	1
Eared Grebe	*Podiceps nigricollis*			1	2		1
Western Grebe	*Aechmophorus occidentalis*		2				
American White Pelican	*Pelecanus erythrorhynchos*	16					
Double-crested Cormorant	*Phalacrocorax auritus*				1		1
Great Blue Heron	*Ardea herodias*		1				1
Snowy Egret	*Egretta thula*		3	1			
Great Egret	*Casmerodius albus*				1		
Tundra Swan	*Cygnus columbianus*			3			
Canada Goose	*Branta canadensis*		24		32	2	
Green-winged Teal	*Anas crecca*		20				
Cinnamon Teal	*Anas cyanoptera*						1
Northern Shoveler	*Anas clypeata*	96	11	12	2		
Mallard	*Anas platyrhynchos*	68	52		31	31	30
Northern Pintail	*Anas acuta*			1			2
Gadwall	*Anas strepera*				4		
American Wigeon	*Anas americana*		8	2	12		
Canvasback	*Aythya valisineria*	3	13	74	7	12	13
Common Goldeneye	*Bucephala clangula*				1		
Bufflehead	*Bucephala albeola*		2	1	1	4	2
Red-breasted Merganser	*Mergus serrator*				1	1	1
Ruddy Duck	*Oxyura jamaicensis*	123	210	280	222	193	114
American Coot	*Fulica americana*	76	76	29	17	26	21
Killdeer	*Charadrius vociferus*			5	1	2	1
Black-necked Stilt	*Himantopus mexicanus*			1			
Greater Yellowlegs	*Tringa melanoleuca*	5	4	3	11	2	
Willet	*Catoptrophorus semipalmatus*		1	3		3	
Western Sandpiper	*Calidris mauri*	5					
Least Sandpiper	*Calidris minutilla*	1	11	3			
Western/Least Sandpiper	*Calidris sp.*	3					
Dowitcher sp.	*Limnodromus sp.*	4					
Ring-billed Gull	*Larus delawarensis*						1

Table 6. Summary of bird observations compiled by Rich Stallcup at Horseshoe Pond.

Species	Count	Rare*	Species	Count	Rare*	Species	Count	Rare*	Species	Count	Rare*
Red-throated Loon	3		Eurasian Wigeon	3		Willet			Heermann's Gull		
Pied-billed Grebe	30		Canvasback	80		Solitary Sandpiper	2	Yes	Mew Gull		
Horned Grebe			Redhead			Spotted Sandpiper			Ring-billed Gull		
Eared Grebe			Ring-necked Duck			Whimbrel			California Gull		
Western Grebe			Greater Scaup			Long-billed Curlew			Herring Gull		
Clark's Grebe			Lesser Scaup			Hudsonian Godwit	1	Yes	Thayer's Gull		
American White Pelican	130		Surf Scoter			Marbled Godwit			Western Gull		
Brown Pelican			Common Goldeneye			Ruddy Turnstone			Glaucous-winged Gull		
Double-crested Cormorant			Bufflehead			Red Knot			Caspian Tern		
Pelagic Cormorant			Hooded Merganser			Sanderling			Elegant Tern		
Great Blue Heron			Red-breasted Merganser			Western Sandpiper			Forster's Tern		
Green Heron			Ruddy Duck			Semipalmated Sandpiper	3	Yes	Black Tern	2	Yes
Black-crowned Night-Heron			Osprey			Least Sandpiper			Belted Kingfisher		
Snowy Egret			Northern Harrier			Baird's Sandpiper	11	Yes	Black Phoebe		
Great Egret			Cooper's Hawk			Pectoral Sandpiper	12	Yes	Tree Swallow		
Tundra Swan	12		Red-tailed Hawk			Sharp-tailed Sandpiper	1	Yes	Violet-green Swallow		
Greater White-fronted Goose	16		Merlin			Stilt Sandpiper	2	Yes	Northern Rough-winged Swallow		
Canada Goose			Peregrine Falcon			Dunlin			Bank Swallow		
Wood Duck			American Coot			Ruff	1	Yes	Cliff Swallow		
Green-winged Teal			Black-bellied Plover			Long-billed Dowitcher			Barn Swallow		
Cinnamon Teal	40		American Golden-plover	4	Yes	Short-billed Dowitcher			Marsh Wren		
Blue-winged Teal	6		Snowy Plover	12	Yes	Common Snipe			Savannah Sparrow		
Northern Shoveler	1100		Semipalmated Plover			Wilson's Phalarope	15		Song Sparrow		
Mallard			Killdeer			Red-necked Phalarope	650		White-crowned Sparrow		
Northern Pintail			American Avocet			Red Phalarope	100		Tricolored Blackbird		
Gadwall			Greater Yellowlegs			Little Gull	1	Yes	Mute Swan		
American Wigeon	800		Lesser Yellowlegs	12	Yes	Bonaparte's Gull					

*Rare Listings: Stallcup notes these bird species as scarce or rare along the California coast. Some of these species are “rare but regular (recorded almost every year somewhere in the Seashore area)” or “entirely lost birds, which have been found but very few times” (Stallcup 2000).

3.1.2.3 Occurrences of Mammals at Horseshoe Pond

Although PRNS staff conducted no formal mammal inventories at Horseshoe Pond, incidental observations have been noted during all field visits. In addition, neither harbor seals (*Phoca vitulina richardsi*) nor California sea lions (*Zalophus californianus*), both protected under the Marine Mammal Protection Act of 1972, are known to have used the site historically as a primary haul-out and resting area. Northern elephant seals (*Mirounga angustirostris*), however, are likely to rest occasionally on the beach, especially sub-adult males during the breeding season between November and March. Other mammals including deer and a small herd of Tule Elk occur within project area. The pond is not a major resource to these larger mammals and changes proposed through this project would not affect these species. Table 7 lists both directly observed species and species presumed present in the area.

Table 7. Mammal species either directly observed or presumed present in the Horseshoe Pond Project Area.

Common Name	Scientific Name	Observation Type
California Mole	*Scapanus latimanus*	Sighting
Shrew	*Sorex spp.*	Sighting
Deer Mouse	*Peromyscus maniculatus*	Sighting
Pocket Gopher	*Thomomys bottae*	Sighting
California Vole	*Micotus californicus*	Sighting
Muskrat	*Ondatra zibethica*	Sighting
Brush Rabbit	*Sylvilagus bachmani*	Sighting
Black-tail Deer	*Odocoileus hemionus*	Sighting
Tule Elk	*Cervus elaphus*	Sighting
Striped Skunk	*Mephitis mephitis*	Sighting
Long-tail Weasel	*Mustela frenata*	Presumed
Gray Fox	*Urocyon cinereoargenteus*	Tracks
Badger	*Taxidea taxus*	Active Burrow
Raccoon	*Procyon lotor*	Tracks
Coyote	*Canis latrans*	Sighting
Feral Cat	*Felis domesticus*	Sighting
Bobcat	*Lynx rufus*	Sighting
Mountain Lion	*Felis concolor*	Presumed
Harbor Seal	*Phoca vitulina*	Presumed
California Sea Lion	*Zalophus californianus*	Sighting
Northern Elephant Seal	*Mirounga angustirostris*	Sighting

3.2 AFFECTED ENVIRONMENT FOR IMPACT ANALYSIS

3.2.1 Geology and Soils

The watershed of Horseshoe Pond is wholly comprised of soils of the Purisima Formation (Clark and Brabb 1997). Consisting primarily of Tertiary siltstone and sandstone formed during the Pliocene, the Purisima Formation forms the cliffs exposed along the length of Drakes Bay. This area is the type section used by Galloway (1977) to describe the Drakes Bay Formation. Work by Clark and Brabb (1997) showed that the Drakes Bay Formation was actually the same as the Purisima Formation, found in Santa Cruz and Monterey areas. This revision in geologic type implies that Point Reyes has actually rafted north along the San Gregorio Fault before joining the San Andreas Fault.

The Purisima Formation represents a shallow, marine shelf depositional environment. Although the Drakes Bay Formation lies on geologic beds dating to the late Miocene in areas, it is overlain only by aeolian (windblown) sand deposits. The formation is somewhat resistant to erosion, but is well exposed along the shoreline cliffs. Marine terraces are also exposed above the cliffs. The area underlying the pond is made up of recent fine grained alluvial fill with a significant organic component.

Soil types were mapped for the Marin County Soils Map (SCS 1985). The soil types surrounding Horseshoe Pond and found within the Project Area are shown in Figure 16. Drainages leading into and out of Horseshoe Pond are characterized by the soil map unit Humaquepts, seeped. This unit consists of nearly level to sloping, poorly drained soils occupying small drainageways. Typically, Humaquepts have three to six inches of sod on the surface, which is 50% or more peaty material. Below this is very dark gray or black loam, clay loam, or clay this is constantly wet. Many areas are subject to deposition of material blown from ocean beaches. These areas have a loamy sand surface layer and are loam or coarser in texture in the underlying material. This soil has a water table at or near the surface throughout winter and spring. During summer and fall, the water table is at a depth of two to five feet. The soils are wet as a result of seepage from higher areas. Deep gullies have developed in a few areas as a result of runoff.

Sirdak sand characterizes the substrate in the vicinity of D Ranch buildings. This very deep, somewhat excessively drained soil is found in rolling, dune-like areas, occupying two to fifteen percent slopes. It formed through wind-blown deposition of sand particles. Slopes are complex. Characteristic vegetation is mainly shrubs and annual grasses. Permeability is rapid, and water-holding capacity is low to moderate. Effective rooting depth is 60 inches or more. Runoff potential is medium, and the hazard of wind erosion is high.

Tomales-Sobega complex soils occur at nine to fifteen percent slopes (located along the ranch road between the old sewage pond and Horseshoe Pond) and fifteen to thirty percent slopes (between D Ranch and the top of Horseshoe Pond's west arm). This soil type occupies upland habitats and consists of 50 percent Tomales fine sandy loam and 30 percent Sobega sandy loam. The Tomales soil occurs on convex side slopes, and the Sobega soil occurs near the upper part of convex side slopes. Runoff potential for the complex ranges from medium to very high and the hazard of water erosion is moderate to high. Effective rooting depth ranges from 20 to 60 inches, increasing with the steepness of the slope. Both the Tomales and the Sobega soils are is moderately deep and well drained, with a low water holding capacity. It formed from sandstone-derived material with very slow permeability. Included in this soil map unit are small areas of seeped Humaquepts in drainageways, Sirdrak soils near the lower part of side slopes, Steinbeck soils on side slopes, and small areas of Bayview and Pablo soils on rounded knolls.

The Tocaloma-McMullin complex occupies 30 to 50 percent slopes on upland areas surrounding east and south shorelines of Horseshoe Pond. The complex consists of 40 percent Tocaloma loam and 35 percent McMullin gravelly loam. The Tocaloma soil is on convex side slopes, and the McMullin soil occurs near the upper part of convex side slopes. The Tocaloma soil is moderately deep and well drained. It formed in material derived from sandstone or shale. Fractured bedrock is at a depth of 30 inches with bedrock at 40 inches. This also defines the effective rooting depth. Permeability of the Tocaloma soil is moderately rapid, water capacity is low, runoff is rapid and the erosion hazard is high. The McMullin soil is shallow and well drained formed from sandstone or shale. Presence of fractured and solid bedrock defining effective rooting depth is at 18 to 20 inches. Permeability of the McMullin soil is moderate, water capacity low to very low, runoff rapid, and erosion hazard high.

The project would wholly occur on soils that were previously disturbed during the construction of Horseshoe Pond and do not now constitute a native soil horizon. In addition, the soils within the project area do not qualify as prime farmland soils and are not integral to long-term agricultural activities in the region. As a feature of a working ranch, the landscape of the Project Area has been modified by human manipulation. A road leading down from D Ranch and the quarry were cut deep into the hillside to provide access to the Pond. The roadbed has not significantly revegetated (see Figure 9). In the quarry especially, deep gullies indicate that physical processes continue to erode these sites, with most water and material washing down the road towards the pond. The road and quarry are visible from the D-Ranch complex, while the dam is visible from both the ranch site and Drakes Beach. The former waste lagoon (proposed Enhancement Site) is visible from the Drakes Beach Road.

Most of the earthen berm flanking the southern shoreline of Horseshoe Pond was built with material excavated from the quarry. Soils within the earthen berm are therefore that of the Tomales-Sobega complex. Although the entire south shore was built up to a higher elevation, the majority of filling

occurred at the historic channel outflow at the western end of the berm. As much as 12 feet of fill was added to the section of the road where it first departs from the quarry towards the pond in order to create a more gradual slope passable by vehicles. A 100-yard stretch of the berm blocking the historic channel has eroded away on the pond side, creating a sheer drop from the berm to the pond shoreline as high as six vertical feet (Figure 17).

The concrete spillway is a conspicuous, man-made structure with no current functional merit. Built in 1988, the concrete spillway measures 60-ft.x12-ft.x3-ft (Figures 7 & 12). Earthen material, taken from a second smaller quarry on the east slope overlooking the spillway, flanks the concrete spillway on both sides. Although once wide enough to drive across, most of the earthen berm here as eroded to a width of approximately 6 feet. The berm stands one and one half to three feet tall.

Debris left within and adjacent to the pond following closure of D Ranch includes old tractor tires, a water heater, and several large pieces of the dam's original culvert structure, including large, concrete blocks and pieces of culvert. The access road leading down to the dam, including the quarry area has an inboard ditch that captures runoff and conducts it down the road. The road is deeply gullied, and delivers sediment directly to the western edge of the dam.

The substrate underlying the open water of Horseshoe Pond includes areas of sand and fine silt and of organic material. Sand composes the bottom substrate in the southern portion of the pond and shoreline as a result of wind-blown deposition and former tidal action through the historic channel. Throughout the remainder of the pond, the substrate is composed of terrestrially-derived fine silts and sediments. In the southwest corner of the pond, a fine silt layer overlies a layer of sand substrate, suggesting that construction of the dam prevented expulsion of fine sediments from the pond, resulting in increased sedimentation of the pond bottom in the last few decades.

3.2.2 Water Resources and Shoreline Process

The 657-acre Horseshoe Pond watershed ranges in elevation from 350 feet to sea level discharging across Drakes Beach directly into Drakes Bay. The lowest end of the watershed historically functioned as a lagoon, with direct ocean connection in the winter and a sand bar disconnecting tidal interaction in the dry summer months. The maximum area submerged under high water conditions is approximately 35-acres, the surface area of the former pond. Since the January 2002 breach event, the water storage capacity and open water surface area have been reduced to approximately 25 acres.

On January 2, 2002, the earthen part of the spillway structure failed, lowering the residual pond elevation by more than 2 feet. This resulted in a substantial reduction in the pond storage capacity. Since this breach event, the beach, and not the spillway, has been the primary control of water level within the former pond. Regardless of the alternative selected for the restoration project, the beach would continue to act as the primary water level control to the lagoon. Therefore the water regime is not expected to be much different than that observed at the site the past two years.

3.2.2.1 Shoreline Process / Marine and Estuarine Resources

Horseshoe Pond has been classified as an Estuarine Intertidal, Emergent, Irregularly Flooded, diked/impounded wetland (Parravano 2002) using the US Fish and Wildlife delineation system (Cowardin 1979). Estuarine System describes adjacent tidal wetlands with low energy and variable salinity, influenced by oceanic tides and often semi-enclosed by land. The Estuarine System extends upstream and landward, ending where ocean-derived salts measure less than 0.5 ppt (parts per thousand) during the period of average annual low flow. Based on this definition, even though the pond has been thought of as a freshwater resource, it is saline enough to require the estuarine distinction.

3.2.2.2 Aquatic Habitat

The aquatic habitat associated with the Horseshoe Pond resource is quantified and evaluated with respect to physical measurements of water depth and capacity. The amount and condition of aquatic habitat varies dramatically with respect to fluctuation in water depth between the summer and winter months. In

December 2001, heavy early rainfall and shifts in sand deposition on Drakes Beach prevented the outflow of the pond and filled it to capacity with a maximum water depth of 4.5-feet. At this height, the water level was above the top of the concrete spillway, partially submerging the southern earthen berm flanking the concrete structure (Figures 10 & 11). The earthen berm remained submerged for almost the entire month of December 2001, presumably becoming completely saturated during this time.

On January 2, 2002, after a night of almost 3 inches of rainfall, the submerged portion of the earthen berm flanking the spillway failed. High flows out of the pond deeply scoured the outflow channel out into Drakes Bay, and water levels within the pond rapidly receeded (Figure 12). By the time the water level became equilibrated, the water level in the Pond had dropped nearly 2.5-feet, reducing the residual storage capacity by nearly 100 acre-feet.

With no rain over the spring and summer, by September 2002 the water in Horseshoe Pond had completely evaporated, leaving a basin of damp, cracked mud (Figure 13). Powerful winter storms in mid-December 2002 refilled Horseshoe Pond with both freshwater run-off and surge-driven seawater. Sand deposition in the outflow channel allowed the pond to fill to the same high levels (submerging the concrete spillway) seen one year earlier in December 2001.

Since the spillway failed in 2002, the residual capacity of the pond has remained far less than the design capacity. The emergent wetland areas mapped on the inboard side of the dam have expanded down to meet the new residual water level. The current water level and water regime conditions are mostly controlled by the freshwater runoff and beach elevation conditions.

3.2.2.3 Salinity Regime

Marine salts within Horseshoe Pond are primarily derived from direct intrusion of ocean water during spillover events, sea spray, and historic retention of salts. Horseshoe Pond receives freshwater surface runoff and occasional inflow of tidal waters at extreme high tide and storm events. The calculated 50-year storm event for the 657-acre watershed is approximately 320 cubic feet per second (NRCS 1988). During the summer and fall months, sand accumulation on Drakes Beach via long shore drift coupled with recession of pond water levels due to evaporation isolates surface water connection between Horseshoe Pond and the marine environment. During monitoring in 2001 and 2002, early winter storms eroded the beach barrier to Horseshoe Pond, filling the existing channel with ocean water up to the spillway structure. Erosion of the beach barrier then allowed for regular inflow of tidal waters during the highest tides of the tidal cycle. In both years, the spillway channel overflowed the concrete spillway into Horseshoe Pond before Horseshoe Pond had reached its maximum capacity.

Prior to the January 2002 breach event, most surface water interaction was storm related, but the current outlet elevation could result in some ocean influence at high tide without any storm surge.

Salinity measured at Horseshoe Pond both before and after the January 2002 breach event has ranged from 0.1 to 14.2 parts per thousand (ppt) within the body of the pond. Depending on freshwater runoff timing and volume, the salinity regime will fluctuate seasonally through the year, with the lowest readings occurring in the winter (high runoff) and highest salinities occurring in the summer (due to the lack of freshwater inflow and rapid evaporation).

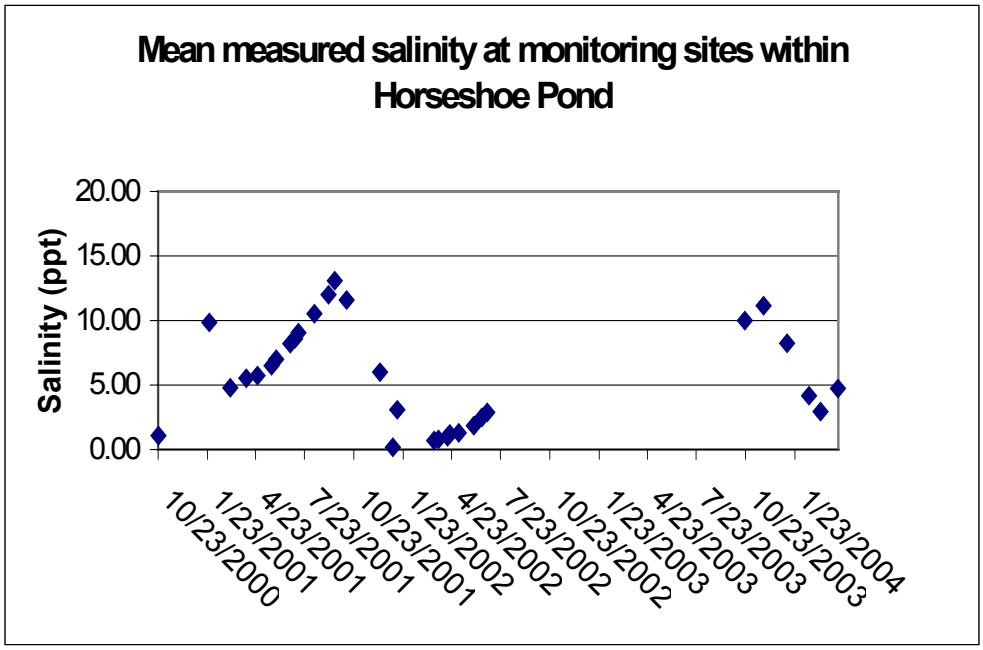
Salinity measurements recorded at a variety of locations within Horseshoe Pond indicate that annual precipitation and freshwater surface runoff primarily drive salinity levels within Horseshoe Pond, with drier years producing higher salinities and wetter years resulting in increased dilution and lower salinity levels. Seawater inflows near or after the end of the rainy season would likely have more prolonged effects on salinity in Horseshoe Pond.

At the onset of water quality monitoring at Horseshoe Pond in October 2000, salinities averaged 1.1 ppt (Table 8). In mid-January 2001, seawater flowed over the spillway into Horseshoe Pond during a high tide and storm surge event and salinity averages in the pond increased to 9.8 ppt. By early March, after a winter where precipitation was measured at only 22.8 inches (65% of normal at the Bear Valley Weather Station),

salinity averages in Horseshoe Pond rested at 4.8 ppt. Through the course of the spring and summer of 2001, salinity levels slowly increased via evaporation to a maximum of 14.3 ppt in October 2001. By December 10, 2001 rainfall, already totaling over 16-inches, had begun to dilute the salts in Horseshoe Pond to 6.0 ppt. By early January 2002, following an additional 14 inches of rain, average salinities had dropped to 0.2 ppt. After the failure of the spillway in January 2002, one spike in salinity was documented in Horseshoe Pond during a high tide event. In the vicinity of the spillway, salinity levels reached 8.4 ppt as seawater flowed though the break in the berm, but salinity levels in the remainder of the pond did not exceed 0.3 ppt.

Table 8. Salinity (ppt) measurements for Horseshoe Pond and estuarine outflow channel.

Date	Pond
10/23/00	1.1
1/26/01	9.9
3/6/01	4.8
4/5/01	5.5
4/26/01	5.8
5/22/01	6.5
5/31/01	7
6/26/01	8.2
7/11/01	9.1
8/10/01	10.5
9/17/01	13.1
10/9/01	11.6
12/10/01	6
1/3/02	0.2
1/11/02	3.1
3/21/02	0.7
3/29/02	0.8
4/15/02	1
5/6/02	1.3
6/18/02	2.5
6/28/02	2.88
10/21/03	10.00
11/25/03	11.15
1/8/04	8.23
2/18/04	4.17
3/10/04	2.95
4/12/04	4.73



3.2.2.4 Water Quality

Physical characteristics, biological processes, and historic land use may account for persistent phytoplankton productivity in Horseshoe Pond. Waste and runoff that entered Horseshoe Pond from the D Ranch dairy operation undoubtedly resulted in high nutrient loading of the system. The dam facility prevented flushing of the pond, and nutrients have since been retained in the pond and recycle back into biologically available forms, both in the water column and in the sediments.

Horseshoe Pond is relatively shallow and unprotected from winds that either blow in from Drakes Bay or originate from the north and are funneled down through the two arms of the watershed. As such, the water column in Horseshoe Pond is well-mixed with a thermocline or isocline only rarely detectable. Because Horseshoe Pond is shallow and there is no mixed layer, phytoplankton carried with the circulating water are

not lost to depths where productivity is inhibited, as occurs for parts of the year in coastal ocean waters. In addition, wind waves that mix Horseshoe Pond to the bottom resuspend nutrients from the sediments into the water column, especially inorganic, biologically available derivatives of nitrogen and phosphorous. Finally, although grazing by zooplankton is well known to control phytoplankton biomass, zooplankton densities may be too low for effective top-down control of phytoplankton, and, in the case of *Spirulina* and other cyanobacteria, are unpalatable to zooplankton.

On several occasions during the summer and early fall of 2001, portions of Horseshoe Pond were bright green in color and dense with the blue-green algae *Spirulina*, a genus commonly associated with high salinity lakes and lagoons. Blue-green algae are well known to dominate the phytoplankton biomass in nutrient-rich waters. Dissolved oxygen was highly saturated in the water column during these blooms, averaging greater than 20 mg/L. Associated bacterial decomposition of phytoplankton following algal blooms may account for periodically low dissolved oxygen concentrations of 3.0 mg/L.

In late May 2001, during unseasonably warm spring weather, a phytoplankton bloom created a red tide in the spillway channel between the pond and the beach (Figure 14). California Department of Health Services Marine Biotoxin Monitoring and Control Program tentatively identified the phytoplankton as *Gyrodinium*, a marine dinoflagellate capable of producing red tides (Langlois, personal communication). A water quality datalogger deployed during the red tide documented remarkable fluctuations in dissolved oxygen concentrations. During daylight hours, photosynthesis boosted dissolved oxygen levels in excess of 20 mg/L. At night, however, in the absence of photosynthesis and with aerobic respiration dominating, dissolved oxygen levels dropped to less than 1 mg/L. Although the red tide persisted for approximately one month, *Gyrodinium* remained in the channel water for the remainder of the summer, producing wide variations in dissolved oxygen concentrations.

On June 27, 2001, PRNS staff documented widespread mortality of three-spine stickleback (*Gasterosteus aculeatus*) in Horseshoe Pond. Winds that day were blowing off of the beach and most fish drifted to the northern sections of the pond where they were observed either floating at the water's surface or washed up on shore (Figure 15). Three-spined stickleback are ubiquitous in the park, surviving in stream and pond areas, and tolerant of warm temperatures, silty substrate, and relatively low dissolved oxygen levels. Field water quality parameters measured on the same day revealed dissolved oxygen concentrations as low as 0.36 mg/L in certain areas of the pond, likely the result of a bloom of an unknown species of rotifer. The U.S. Environmental Protection Agency recommends ambient water quality criteria for dissolved oxygen above 4.8 mg/L to insure that aquatic life is not harmed. Dissolved oxygen concentrations below 2.3 mg/L do not meet the survival criterion for juvenile and adult fish. Interestingly, on the same day, other areas of Horseshoe Pond had a dense bloom of photosynthetic *Spirulina*. In these areas, the dissolved oxygen concentrations reached 15.66 mg/L.

The fish kill event revealed to PRNS biologists that water quality conditions in Horseshoe Pond were more severe than previously thought. The fish kill also suggested why other fish species, such as herring, sculpin, surf perch, or smelt, all of which are found in Abbotts Lagoon (Saiki 2000), may not have survived in Horseshoe Pond since its closure. Larger fish have higher oxygen demands (Moyle and Cech 1996), and may have been extirpated from the system during previous anaerobic events. Alternatively, wide variations in salinity levels throughout the year may have prevented the survival of other fish species in Horseshoe Pond. Three-spine stickleback may be found in both estuarine and freshwater streams habitats (Moyle 2002), and their persistence in Horseshoe Pond would be expected.

3.2.3 Cultural Resources

The following information is from a technical report that was prepared for the Project Area by Newland in 2002 with final additions and revisions April 2004. The report describes the archeological studies that have been performed within and around the study area in the past.

3.2.3.1 Prehistoric Period

The Point Reyes area can be included in the analytic framework for the interpretation of the North Coast and central California prehistory constructed by Fredrickson (1974), who divided human history in California into three broad periods: the Paleoindian period, the Archaic period, and the Emergent period. This method used sociopolitical complexity, trade networks, population, and the introduction and variations of artifact types to differentiate between cultural units. Fredrickson's method with minor revisions, remains the dominant framework for prehistoric archaeological research in this region.

Within this general framework, the Paleoindian period (10,000–6000 B.C.) was characterized by small, highly mobile groups occupying broad geographic areas. During the Archaic period, consisting of the Lower Archaic period (6000–3000 B.C.), Middle Archaic period (3000–500 B.C.), and Upper Archaic period (500 B.C.–A.D. 1000), geographic mobility may have continued, although groups began to establish longer-term base camps in localities from which a more diverse range of resources could be exploited. The addition of milling tools, obsidian and chert concave-base points, and the occurrence of sites in a wider range of environments suggest that the economic base was more diverse. By the Upper Archaic period, mobility was being replaced by a more sedentary adaptation in the development of numerous small villages, and the beginnings of a more complex society and economy began to emerge.

During the Emergent period (A.D. 1000–1800), social complexity developed toward the ethnographic pattern of large, central villages where political leaders resided, with associated hamlets and specialized activity sites. Artifacts associated with this period are the bow and arrow, small serrated corner-notched points, mortars and pestles, and a diversity of beads and ornaments that became especially abundant (Gerike et al. 1996:3.11-3.17). Most sites in PRNS that have been dated appear to fall into the Emergent period (e.g., Origer 1982, 1987; King and Upson 1970; Von der Porten 1963a), although at least two substantial Upper Archaic-period sites, the McClure site and the Cauley Site (CA-MRN-242), are represented (Beardsley 1954:59; Moratto 1970:271). CA-MRN-242 has not been destroyed and is being considered for site stabilization treatment. Other sites dating to the Upper Archaic or earlier may be present in the PRNS under alluvial or colluvial sediments.

3.2.3.2. Ethnographic Period

The Project Area was inhabited by the Coast Miwok Indians in the prehistoric past and at the time of contact. The Coast Miwok language, a member of the Miwokan subfamily of the Utian family, is divided into two dialect groups: Western (Bodega) and Southern (Kelly 1978:414; Shipley 1978:84). The Coast Miwok territory extended from Duncan's Point on the Sonoma County coast to the end of the Marin County peninsula (Kroeber 1925). Coast Miwok territory extended east as far as midway between the Sonoma and Napa Rivers (Kelly 1978). These boundaries are based on common linguistic associations rather than representing a common sociopolitical organization. Kroeber (1925:831) defined the largest unit of political organization as a tribelet, which encompassed the village community.

Coast Miwok sociopolitical organization did not extend beyond the village. Larger villages had a chief, whose position was nonhereditary. The chief's responsibilities included advising and caring for the villagers and overseeing activities in the dance house. Incipient chiefs were tutored by the current chief and four elderly women (Kelly 1978:419). Other important leaders included the woman chief and the *máien*. The woman chief appears to have been primarily a ceremonial leader, who was involved in the Bird Cult and coordinated the Acorn Dance and the Sünwele Dance. The *máien* was the head of the female ceremonial house and directed the construction of new dance houses, had wood hauled for festivals, supervised the preparation of foods for special events, sent invitations to dances, and sometimes selected dance performers (Kelly 1978:19). Dances were important to the Coast Miwok and were held frequently.

Contact between the Coast Miwok and Europeans first occurred on the Marin County coast as early as 1579, when Sir Francis Drake spent five weeks on the coast to repair his damaged ship (Kroeber 1953:275). Spanish explorers then made contact with the Coast Miwok in the late 1700s. The Spanish colonial mission was to turn the Native American population into Spaniards through religion, language and gradually, the intermixing of blood (Bean and Rawls1993:17). By 1776, the Franciscan fathers of the San Francisco mission began forced conversions of Native Americans to Christianity and brought Coast Miwok to mission lands, causing a partial abandonment of native settlements. Subsequent ranching and settlement

by Mexicans and Americans further displaced Coast Miwok from their homes and subjected the group to intense depredations of homicide and epidemic diseases (Cook 1976).

Many of the Coast Miwok were taken to the San Francisco Mission Dolores, established in 1776, Mission San Jose de Guadalupe, established in 1797, and the Mission San Rafael Arcangel, established in 1817, to be converted. Large groups were taken, ranging in numbers from approximately 40 to 150 tribal members at a time (Milliken 1995). Their numbers decreased rapidly, as did the Native American populations throughout the Bay Area and California.

In the early 1920s, the Bureau of Indian Affairs purchased land near the city of Graton and placed it in government trust as a rancheria for the remaining 75 Coast Miwok and Southern Pomo that shared their territory (Campbell et al. 2002). Today, the Coast Miwok population has increased to 366 individuals and is represented by the federally-recognized Federated Indians of the Graton Rancheria located in Graton, with offices in Santa Rosa and Novato (Campbell et al. 2002 in Newland 2002).

3.2.3.3 Historic Period

The Point Reyes–Drakes Bay–Tomales Bay region was one of the earliest areas described by European explorers who traveled the California Coast. The Point Reyes cape is thought to have been discovered by Cabrillo in 1542; almost four decades later, in 1579, Francis Drake dropped anchor along the coast at what is though to have become Drakes Bay, just east of Point Reyes (Hoover et al. 1990:172–173). Sixteen years after Drake's landing, the *San Augustin*, a Manila galleon piloted by Sebastián Rodríguez Cermeño, entered Drakes Bay. The ship, loaded with oriental trade goods and heading for Acapulco, was wrecked by a violent storm three weeks after its arrival in November of 1595. Asian ceramic fragments have been found on the beaches throughout Drakes Bay from the wreck. Before returning to the sea in a launch, the crew explored inland from the bay a distance of four leagues (about three and a half miles), making contact with several Coast Miwok villages and obtaining acorns from them (Hoover et al. 1990:172-174; Moratto 1974:5).

In 1603, the Vizcaíno expedition was the one to bestow the name *Punta de los Reyes* on the point, after the day of *los reyes magos*, the "three holy kings" (Gudde 1998:315). The Vizcaíno expedition discovered Tomales Bay that same year, though they assumed that the narrow bay was a river (Gudde 1998:396). Tomales Bay may be named either for the Tamal Indians, a group of Coast Miwok who appear in the baptismal records of Mission Dolores between 1802 and 1810 (Milliken 1995:255), or for the Coast Miwok word "tomales," or bay (Gudde 1998:396; Hoover et al. 1990:180).

After contact with these explorers, it was almost 200 years before Europeans returned to the area. In 1776 the Mission San Francisco de Asis was established and numerous other missions and associated pueblos were settled across the bay area. The Project Area is in the Rancho Punta de Los Reyes (Sobrante) land grant. The nearby Rancho Punta de Los Reyes, a separate grant from the Sobrante property, consisted of a 35,000-acre grant made in 1836 to James Richard Berry, an Irishman, who shortly thereafter sold a portion of the rancho to Joseph Snook, who in turn sold his portion to Antonio María Osio in 1843. Osio obtained the rest of the original grant and was also granted the remaining 48,000 acres of land on Point Reyes, titled the Rancho Punta de los Reyes Sobrante ("surplus" or "leftover land"). This settlement led to the founding of numerous ranches and dairies in the Point Reyes regions (Newland 2002).

3.2.3.4 Archeological and Historic Sites Identified in the Project Area

The first archaeological surveys of the Tomales Bay/Point Reyes area were conducted in the early 1900s by Nels Nelson of U.C. Berkeley (Nelson 1909). These first surveys identified dozens of prehistoric archaeological sites in and around the Point Reyes peninsula. Jesse Peters, between 1911 and 1913, conducted surveys from the southern border of Sonoma County south into Marin County. Several years later, S.F. Bryant, in 1934, recorded and mapped several prehistoric sites within the area that would become Point Reyes National Seashore.

Beardsley (1954) framed a cultural sequence for the area, relating it to the greater San Francisco Bay/Sacramento Delta areas; the earliest recognized culture at that time was the McClure Facies, which

corresponds to the Middle Horizon, ca. 1,000 B.C. to A.D. 500. Von der Porten and the Drake Navigators Guild conducted a series of excavations around the Point Reyes peninsula during the early 1960s. The primary intent of these studies was to identify remains of Francis Drake's or Sebastian Rodrigues Cermeño's encampments or shipwrecks. In the search for evidence of these encampments, however, Von der Porten (1963a) excavated several prehistoric shellmounds within the area, and documented both prehistoric and historic-period artifacts and features.

Several recent surveys were conducted by Jablonowski (2002, pers. comm.) under a cooperative agreement between the Anthropological Studies Center and the NPS. Using intern or volunteer labor, Jablonowski revisited numerous archaeological sites throughout the park. Jablonowski visited the location of CA-MRN-394/H at the current Horseshoe Pond project area in 1999 and conducted an augering program, but was unable to relocate the site.

An archaeological survey was conducted by Anthropological Studies Center (ASC) staff in November and December of 2001 that identified two cultural resources within the Project Area. This technical report is referenced as An *Archaeological Study for the Pont Reyes Coastal Watershed Restoration Project, Point Reyes National Seashore, Marin County, California*, Michael Newland, 2004. Follow-up surveys were conducted on the site in 2002 and 2003. The intent of these surveys was to document the extent of the site MRN/394/H, allowing for planning to avoid impacts to archaeological site. Through these surveys, the extent of the site was documented, so that construction activities could avoid this specific area. The ASC report also documents the remains of a ship that washed to the former lagoon mouth prior to the dam construction. The remains of this ship are often submerged below the sand, but have been exposed in some winters by erosion of the beach. The location of the remains are documented and construction would avoid this area. The results of the ASC research were used to develop the action alternatives so that implementation would result in findings of no effect to cultural resources.

3.2.4 Vegetation

Botanical surveys were conducted at Horseshoe Pond by PRNS plant/wetland specialists Lorraine Parsons, Michelle Coppoletta, and Shelly Benson (Parsons 2002). Surveys were timed to coincide with both the documented and observed flowering periods of sensitive species with potential to occur in habitats observed in the Project Area. The complete botanical report of Horseshoe Pond is available by request from PRNS.

A variety of habitats characterize the Project Area, including coastal freshwater and brackish marsh, salt marsh, coastal dune, non-native annual/perennial grassland, native perennial grassland, and scrub. East-facing slopes leading down to the west shoreline of Horseshoe Pond, along the north side of the ranch road leading down to the dam, are dominated by mesic coyote brush (*Baccharis pilularis*) scrub with patches of spreading rush (*Juncus effusus*) and Pacific reedgrass (*Calamagrostis nutkaensis*). Vegetation along the earthen levee impounding Horseshoe Pond is characterized by coyote brush scrub associated with bush lupine (*Lupinus arboreus*), blackberry (*Rubus ursinus*), and Douglas iris (*Iris douglasiana*). Upland slopes surrounding northern and eastern shorelines and along construction access roads are predominantly mixed native perennial and non-native annual grassland with scattered, low-growing coyote brush shrubs, blackberry, and Douglas iris.

Wetland vegetation characterizing a saltmarsh along the oceanward side of the spillway is dominated by salt rush (*Juncus leseurii*) and salt grass (*Distichlis spicata*). Just south of this area, beach vegetation is composed of a mix of native coastal sand dune plant species and European beachgrass (*Ammophila arenaria*). West of the beach on the oceanward side of the levee is a brackish marsh dominated by salt rush, saltgrass, and *Scirpus pungens*. Along the pondside shoreline of the levee is also a brackish marsh dominated by *Scirpus pungens*. Potential alternatives would result in open beach areas, which could be colonized by European beach grass. Site surveys would be conducted following restoration to prevent intrusion and establishment of European beach grass in this area.

Located approximately 650 feet south of the D Ranch building complex is a former waste pond that has been chosen as Potential California red-legged frog Enhancement Site. Disturbed vegetation in this area

reflects the degraded condition of this site. When this site was initially surveyed during late summer, the waste pond was largely dried up with the exception of two flooded portions with little to no emergent vegetation cover. The soil surface was dry and cracked, covered with mineral salt deposits and weedy, pioneering annual forbs, perennial ryegrass (*Lolium perenne*), and Italian ryegrass (*Lolium multiflorum*). Two additional wet, depressional areas are present just north of the pond basin and adjacent to the construction access road south of D Ranch. A disturbed area dominated by lambsquarters (*Chenopodium album*), associated with annual rabbitsfoot grass (*Polypogon monspeliensis*) and spikerush (*Eleocharis macrostachya*) was situated on the backside of the earthen levee impounding the sewage pond. Immediately adjacent and to the east is a tiny depression at the base of a culvert that crosses the access road. This area was dominated by non-native annual/perennial grassland, composed primarily of barley (*Hordeum murinem*) and perennial ryegrass (*Lolium perenne*). Across the access road is a small swale draining surface flow from D Ranch, down into the culvert at the bottom of the hill. Vegetation characterizing this wetland is also non-native annual/perennial grassland.

3.2.5 Wetlands

3.2.5.1 Jurisdictional Wetlands and Waters of the United States

Pursuant to Section 404 of the federal Clean Water Act and Section 10 of the Rivers and Harbor Act, a potential jurisdictional study was conducted to map and describe areas within the Delineation Study Area (Study Area) under federal jurisdiction. A delineation of potential jurisdictional Section 404 wetlands and "other waters" was performed on July 19 and August 16, 2001 (Parsons et al. 2002). The delineation characterizes areas potentially subject to U.S. Army Corps of Engineers (USACOE) jurisdiction under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act and was performed in accordance with the *Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987). The Delineation Study Area included selected adjoining areas beyond the Project Area boundary to allow for demarcation of sensitive areas to be avoided when transporting equipment and/or supplies to the Project Area. In August 2002, the USACOE concurred with and approved the NPS delineation of jurisdictional waters and wetlands at Horseshoe Pond (File No. 26983N).

The Delineation Study Area only incorporated the portion of Horseshoe Pond closest to the Project Area. The Project Area and selected adjoining areas, potential jurisdictional Section 404 tidal waters totaled 6.45 acres, and potential jurisdictional Section 404 tidal wetlands totaled 3.03 acres. It should be noted that the delineated area is only part of the overall 35 acre Horseshoe Pond Area. Tidal waters and wetlands -- or unvegetated and vegetated areas below the High Tide Line (HTL) -- occurred on either side of the earthen dam and near the spillway and included both the tidal inlet and waters of the pond itself. Potential jurisdictional adjacent wetlands totaled 0.36 acres; these were comprised of areas above the High Tide Line that met the soils, vegetation, and hydrology criteria for wetlands. Potential jurisdictional Section 404 isolated waters totaled 0.36 acres, while potential jurisdictional Section 404 isolated wetlands totaled 0.55 acres. Non-jurisdictional wetlands were identified along potential access roads and at the California red-legged frog enhancement site.

The complete report of this wetland delineation at Horseshoe Pond is available by request from PRNS.

3.2.5.2 Section 10 – Rivers and Harbors Act (1899)

Section 10 Corps jurisdiction extends to mean high water (MHW) and includes tidal areas presently subject to tidal influence, as well as unfilled areas currently behind levees that were historically below MHW. MHW for Drakes Bay is 2.26 feet in the National Geodetic Vertical Datum of 1929 (NGVD29) (Bergquist 1978). MHW for the study area was converted to the North American Vertical Datum of 1988 (NAVD88). MHW in the NAVD88 datum is 4.88 feet. Based upon LIDAR data, a total of 0.41 acres of Section 10 jurisdictional waters are within the Delineation Study Area, but only on the oceanward side, and not within the existing channel or pond area.

3.2.5.3 California Coastal Commission and NPS Wetland Determination

Director's Order #77-1 established Park Service policies, requirements, and standards for implementing Executive Order 11990 (Protection of Wetlands; 42 Fed. Reg. 26961). To delineate which areas would be

subject to Director's Order #77-1, the Park Service elected to use the classification system developed by the U.S. Fish and Wildlife Service (FWS), "Classification of Wetlands and Deepwater Habitats of the United States," (FWS/OBS-79/31; Cowardin et al. 1979), as the standard for classifying, and inventorying wetlands. This system is typically referred to as the Cowardin classification system.

Within California, the California Coastal Commission (CCC) administers the state program (California Coastal Act) for implementation of the federal Coastal Zone Management Act (CZMA). Any action by a federal agency, such as the NPS, requires a federal consistency determination by the CCC per CZMA. In the coastal zone, the CCC, with assistance from the California Department of Fish and Game (CDFG), is responsible for determining the presence and size of wetlands subject to regulation under the Coastal Act. The CCC has adopted the CDFG wetland definition and classification system, which is a modified version of the Cowardin classification system. The Project Area lies within the coastal zone and is subject to a wetland assessment on the part of the CCC.

A survey to map and describe wetlands within the Project Area according to methods outlined by the United States Fish and Wildlife Service (USFWS) Cowardin Wetland Classification System (Cowardin et. al. 1979) was conducted on 8/17/01 and 9/4/01 (Parravano 2002). The complete report of Cowardin wetland delineation at Horseshoe Pond is available by request from PRNS.

Kevin Noon, NPS Water Resources Division, has reviewed this project and determined that::

> "There will be no need for a Wetland Statement of Findings to accompany the EA because of the exemption for NPS restoration projects as described in the NPS Procedural Manual 77-1 (NPS, 1998) which provides implementation guidance for Director's Order 77-1, Wetland Protection (NPS 2002). Further, a Wetland Statement is not required in cases, such as this project, when there is no long-term loss of wetland area."(NPS 1998)

3.2.6 Special Status Species

A determination of the special status species with potential to occur in the Project Area and be affected by project actions was initially conducted by performing a literature review. The literature review consisted of a search of the following:

- California Natural Diversity Database (NDDB) for occurrences of special status species and habitats in all 7.5 minute USGS quadrangles within PRNS (NDDB 2001).
- USFWS endangered and threatened species list for PRNS and Marin County (April 2001).
- Evens, J. G. 1988. The natural history of the Point Reyes Peninsula. Point Reyes National Seashore Association, Point Reyes Station, CA.
- Stallcup, R. 2000. Field checklist of birds for Point Reyes National Seashore. Point Reyes National Seashore Association, Point Reyes Station, CA.
- Erlich, P. R., D. S. Dobkin, and D. Wheye. 1988. The birder's handbook. Simon and Schuster, New York, NY.
- Page, Gary and J. White. 1999. Bird Inventory of Three National Parks of the San Francisco Bay Area: Wintering Waterbirds and Shorebirds. Unpubl. Rep., Point Reyes Bird Observatory, Stinson Beach, CA.
- Point Reyes National Seashore rare plant database (PRNS 2001).
- Point Reyes National Seashore plant list database (PRNS 2001).
- California Native Plant Society (CNPS). 2001. Inventory of rare and endangered plants of California. Sixth Edition.

The literature survey found 100 species with the potential to occur within the Horseshoe Pond Project Area. The determination was based on consideration of known species ranges, minimum habitat requirements, the occurrence of required habitat within the Project Area, and historical sightings at Point Reyes. Included for review are species listed, or since delisted, as threatened or endangered under the federal Endangered Species Act (ESA). In addition, species designated as "species of concern", former Category 2 candidates for listing under the ESA, are included for review in conformance with NPS Management Policies for

management of threatened and endangered plants and animals (NPS 2000, Sec. 4.4.3.2). The NPS is directed to manage state and locally listed species in a manner similar to its treatment of federally listed species, to the greatest extent possible.

Comprehensive field surveys were initiated to confirm the presence or absence of these species. Wildlife surveys of the Project Area were initiated in April 2001 by PRNS biologist David Press. Formal amphibian surveys began in August 2001 by USGS-BRD biologists Gary Fellers, Greg Guscio, and Patrick Kleeman. Lorraine Parsons, Michelle Coppoletta, and Shelly Benson of PRNS conducted the botanical surveys.

3.2.6.1 Special Status Amphibians

California red-legged frogs (*Rana aurora draytonii*), the only special status amphibian with the potential to exist at Horseshoe Pond, were first documented at Horseshoe Pond by USGS-BRD surveys in August 1995 (Fellers and Guscio 2002). The Horseshoe Pond Project Area is located within the area designated as critical habitat for the federally-threatened California red-legged frog (CRLF). PRNS anticipates that the focal issue in its consultation with USFWS will revolve around the potential for impact to the CRLF population and critical habitat. This site is unusual in that PRNS staff has documented the presence of the CRLF, despite the fact that the waterbody is classified as estuarine – having an average salinity of >0.5 ppt during the low flow season (summer). Salinity is addressed in detail in Section 3.2.2.3.

The CRLF was once an abundant frog throughout much of California, but is now completely extirpated in the floor of the Central Valley (Fisher and Shaffer, 1996) and nearly extirpated in both the Sierra Nevada foothills and in the southern 1/4 of its range. The listing under the Endangered Species Act in 1996 was necessary because the frog is absent from more than 70% of its original range and is threatened within its remaining range by a wide variety of human impacts, including urban encroachment, construction of reservoirs and water diversion, contaminants, agriculture, and livestock grazing (USFWS 2000). In a few parts of the central coast range, there are still large, vigorous populations, some of which probably rival what was present 200 years ago (Fellers, *in press*).

The largest known populations of CRLFs are at PRNS where there are more than 120 breeding sites with a total adult population of several thousand frogs. Peak egg laying by CRLFs at Point Reyes is in January and occurs in slow moving or static water systems. Most of the breeding sites at PRNS are artificial stock ponds constructed on lands that have been grazed by cattle for 150 years. There is much less information on habitat requirements away from the breeding sites. Data from radio-tagged CRLFs suggest that riparian areas provide critically important habitat for frogs during most of the year (Fellers, *in press*). This type of habitat is likely essential to the continued survival of CRLFs, particularly in dry years when water in breeding ponds is not likely to persist.

Though not as concentrated, there are good populations of CRLFs elsewhere in the San Francisco Bay area (especially Alameda and Contra Costa Counties) and in the coastal drainages from San Mateo County (just south of San Francisco) south to Santa Barbara County. One of the largest single populations consists of an estimated 350 adult frogs at Pescadero Marsh (San Mateo County) (Fellers, *in press*).

The Draft Recovery Plan for the CRLF reports that eggs exposed to salinity levels greater than 4.5 ppt experience 100 percent mortality and that larvae die when exposed to salinities greater than 7.0 ppt (USFWS 2000). Although Fellers and Guscio (2002) recorded a maximum salinity of 1.1 ppt, PRNS has observed salinity ranges from 0.1 ppt to 13.1 ppt during the environmental analysis of Horseshoe Pond (see Section 3.2.2.3), with CRLF present at all times. The egg mass surveys did not occur across a range of salinity levels (Fellers and Guscio 2002), and there is no information on breeding activity and success during periods when salinity levels are elevated in Horseshoe Pond. Based on the data in the Recovery Plan, it can be assumed that breeding success is lower during breeding seasons with high salinity, such as in 2001, when salinity levels between January and March ranged from 4.8 ppt to 9.9 ppt. Even under high winter salinity conditions, tadpoles were observed in areas with salinities up to 8.6 ppt. (B. Ketcham, pers. com.).

PRNS contracted with Dr. Gary Fellers of the USGS-BRD to perform focused surveys for CRLFs at Horseshoe Pond and its vicinity. These surveys have confirmed the presence of CRLF breeding within Horseshoe Pond, with maximum counts of 33 egg masses and 148 adults. The final report of CRLF breeding at Horseshoe Pond completed in May 2002 by Fellers and staff (Fellers and Guscio 2002) is available on request from PRNS.

These surveys occurred during and after the dam breach, as the system transitioned from one baseline state (with the spillway) to the current configuration. Since the breach of the dam and changed water and vegetation conditions, the number of frogs observed in the pond was noticeably reduced. Surveys in February-March 2003 indicated presence of the CRLF but in numbers far lower (30-40 individuals) than those observed in 2002. A rebound in frog use has recently been observed, with a total of 130 individuals counted during an April 2004 survey.

Egg masses were documented in lower numbers than that reported in 2002. While the expansion of vegetation to the new shoreline has improved conditions, the shift to an open system makes the water body more subject to fluctuation in salinity levels.

Discussions with USGS-BRD biologists acknowledge that since the breach event, observations had shown a population approximately 25% of that observed before the breach. The area is still used as breeding habitat, with a rebound in use observed in spring 2004 (Kleeman, personal communication). The water regime is currently driven by rainfall-runoff and shoreline dynamics. Because the proposed alternatives would not change these controls, the water regime after restoration will likely remain similar to current conditions.

The proposed project enhancement site is located upland, nearer the ranch complex in a former waste lagoon. The pond derives water from rainfall only. The current configuration is very steep and deep with little to no transition between upland and pond areas. No typical pond vegetation, typha, bulrush, or other species have been able to establish along the edge of the pond due to this abrupt transition. Frogs have been observed at this location, though in its current state, the habitat is not conducive to successful breeding or reproduction.

3.2.6.2 Special Status Plants

The literature survey identified 53 special status plant species with the potential to occur within the Horseshoe Pond Project Area. Field surveys were conducted in accordance with USFWS (1996) and California Department of Fish and Game (1997) guidelines in order to confirm the presence or absence of these species. All plant species observed were identified to the level necessary to ensure that any special status species present would be detected. While several taxonomic keys were used to identify plant species observed (e.g., Hickman 1993, Mason 1969, Howell 1970), scientific and common nomenclature followed *The Jepson Manual* (Hickman 1993).

Marin County is the southern extent of the range for pink sand verbena, which stretches as far north as Oregon (CNPS 2001). Pink sand verbena (*Abronia umbellata* ssp. b*reviflora*), is a federal species of concern and is a CNPS List 1B 2-3-2 (limited number of occurrences, endangered throughout its range, and rare outside of California). These populations are very dynamic in nature and appear to be adapted to disturbance areas perhaps functioning almost like metapopulations. During one season, a few plants will appear in certain areas, particularly dunes that have been recently disturbed by overwash events, only to disappear the following season, with new occurrences then sighted in other locations. Throughout its range, this species has experienced a dramatic decrease in numbers due to impacts such as off-road vehicles, non-native plants, and foot traffic (CNPS 2003). This annual herb, which blooms from June through October, is distinguished by its distinctive magenta flowers. Most occurrences of this species within PRNS have low numbers of individuals, ranging from one or two to 13 individuals in a season (CNPS 2001). Within PRNS, there are five occurrences of this species (NPS 2001b).

The Horseshoe Pond population ranks as the largest and most stable of the pink sand verbena populations within PRNS. Scattered throughout approximately 0.26 acres of dune habitat, this population is located

close to planned restoration activities near the historic channel and adjacent to the access road that would be used to access the spillway facility. In 2001, as many as 65 plants were found by Michelle Coppoletta of PRNS, 26 of which were in flower (NPS 2001b). In 2002, 22 flowering plants were observed (Shelly Benson 2002 personal communication).

Chorizanthe cuspidate, has also been located in the dunes in front of Horseshoe Pond. PRNS botanists are unsure however if this species is *Chorizanthe cuspidata* var. *cuspidata*, San Francisco Bay spineflower, or *Chorizanthe cuspidata* var. *villosa*, wooly headed spineflower (CNPS 2003). Because of difficulties discerning different varieties, the Seashore mapping program has lumped the two rare species (Michelle Coppoletta, personal communication). Both species are listed by the Sacramento Office of the Fish and Wildlife Service as federal species of concern (USFWS 3/1/2004) and listed by CNPS as 1B (rare and endangered in California and elsewhere). These species are quite common in the Seashore with most existing populations located in and around the Abbotts Lagoon dunes (PRNS 2001). *Chorizanthe cuspidate* is located adjacent to the access road, intermixed with the population of pink sand verbena.

Marsh milkvetch *Astragalus pycnostachyus* var. *pycnostachyus* occurs in the strip of rushes bordering the high marsh near the concrete spillway. At least two large individuals have been located within the project area. Astragalus historically ranged from Humboldt to San Mateo Counties, but may be extirpated from Humboldt County (CNPS 2003). CNPS (2003) characterized this species as having potentially fewer than 15 occurrences in 3 counties. There are at least 13 occurrences within PRNS, most of which are in tidal fringe marshes bordering the various "bays" in Drakes Estero and Estero de Limantour (NPS 2001b). Declining numbers are apparently what prompted CNPS to include this species for the first time in its 2001 rare plant inventory as a List 1B species (rare or endangered in California or elsewhere).

3.2.6.3 Special Status Mammals

The literature review identified potential occurrences of two species considered USFWS species of concern, the southwestern river otter (*Lutra canadensis sonorae*) and the Point Reyes jumping mouse (*Zapus trinotatus orarius).* Neither harbor seals (*Phoca vitulina richardsi*) nor California sea lions (*Zalophus californianus*), both protected under the Marine Mammal Protection Act of 1972, are known to have used the site historically as a primary haul-out and resting area. Northern elephant seals (*Mirounga angustirostris*), however, are likely to rest occasionally on the beach, especially sub-adult males during the breeding season between November and March.

3.2.6.4 Special Status Birds

The literature review concluded that 32 birds listed either as federally endangered, federally threatened, or considered a federal species of concern by the USFWS have the potential to occur with the Horseshoe Pond Project Area. PRNS field surveys and Stallcup surveys (unpubl. data) recorded the following eight federal species of concern within the Project Area at Horseshoe Pond: tricolored blackbird (*Agelaius tricolor*), grasshopper sparrow (*Ammodramus savannarum*), American bittern (*Botaurus lentiginosus*), saltmarsh common yellowthroat (*Geothlypis trichas sinuosa*), long-billed curlew (*Numenius americanus*), bank swallow (*Riparia ripari*), Allen's hummingbird (*Selasphorus sasin*), and snowy egret (*Egretta thula*). Literature regarding the nesting habits of Tricolored blackbirds, grasshopper sparrows, saltmarsh common yellowthroat, and Allen's hummingbird indicate that these species likely nest either regularly or periodically within the Horseshoe Pond Project Area.

Federally endangered brown pelicans (*Pelecanus occidentalis*) are now fairly common along the coastline of PRNS. On one occasion, a brown pelican was observed on the surface of the pond engaged in preening activities. During the spring and fall migrations, American peregrine falcons (*Falco peregrinus anatum*), a now federally delisted species, are attracted to Horseshoe Pond by the large numbers of gathering shorebirds and waterfowl.

Since 1986, the Point Reyes Bird Observatory has conducted regular surveys to Drakes Spit to survey for federally threatened western snowy plovers (*Charadrius alexandrinus nivosus*) during spring breeding seasons (Abbot and Peterlein 2001). On the way to Drakes Spit, surveys for western snowy plovers were made along the beach in front of Horseshoe Pond. Since 1986, no nesting snowy plovers have been

observed at Horseshoe Pond due to lack of habitat that is dune-backed and/or safe from high tides and human recreation. However, wintering snowy plovers have been observed along the beach in front of Horseshoe Pond, with as many as 12 individuals present at a time (Stallcup, unpublished data).

3.2.6.5 Special Status Reptiles

The only special status reptile with the potential to exist at Horseshoe Pond (Appendix A) does reside there. The western pond turtle (*Clemmys marmorata marmorata*), a federal species of concern, has been documented year-round, basking on the banks of the pond and on large tractor tires remaining along the edge of the pond. Western pond turtles are known to occur in aquatic habitats that range in salinity content from fresh to brackish to seawater. Nests at Horseshoe Pond have been observed in grassy upland habitats within 50-yards of Horseshoe Pond. Western pond turtles have not been observed at the Enhancement Site.

3.2.6.6 Special Status Fish Species

Three listed fish species; tidewater goby (*Eucyclogobius newberryi* FE), coho salmon (*Oncorhynchus kisutch* FT), or steelhead trout (*Oncorhynchus mykiss* FT) have the potential to occur in the Drakes Bay Quadrangle, (Appendix A), but none occur within the project area. Neither Horseshoe Pond nor the Enhancement Site support federally listed fish species.

The Recovery Planning Team for the tidewater goby is drafting a recovery plan for the species that includes documentation of potential habitat for reintroduction to establish satellite populations to protect of unique genetic stocks. The planning team has identified the Horseshoe pond area as a potential reintroduction site (Jacobs 2004 personal communication). The site would provide good potential habitat for the tidewater goby. As it is not likely that the site was surveyed for fish species prior to the lagoon being dammed in the late 1940s, the planning team considers the site, functioning like a lagoon rather than a pond, as good potential habitat for experimental reintroduction of a Rodeo Lagoon population (Jacobs 2004 personal communication).

3.2.6.7 Special Status Invertebrates

The literature review identified eight special status invertebrate species with the potential to occur at Horseshoe Pond. None of these were documented as part of site surveys.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 METHODS OF ANALYSIS

NEPA requires that an EA disclose environmental impacts of the proposed federal action, reasonable alternatives to that action, and adverse environmental effects that cannot be avoided if the proposed project action is implemented. This section of the EA analyzes the potential environmental impacts of the proposed project on water resources, cultural resources, wildlife, vegetation and special status species. NEPA also requires consideration of context, intensity, and duration of direct impacts, indirect impacts, and measures to mitigate impacts. NPS policy requires that "impairment" of resources be evaluated in all environmental documents. The following definitions are used to evaluate the project alternatives.

Context is the setting within such an impact is analyzed. In this environmental assessment the intensity of impacts are evaluated within a local (Project Area) context and the intensity of the contribution of effects to the cumulative impacts are evaluated in a regional context, (e.g. park-wide).

Intensity is a measure of the severity of an impact. The intensity of an impact may be **Negligible, Minor**, **Moderate**, or **Major.** The intensity of impacts are described for each impact topic in Section 5.2.

Duration is a measure of the time period over which the effects of an impact persist. The duration of the impacts evaluated in this EA is defined as ***Short-term or Long-term***.

Type of Impact. Impacts were evaluated in terms of whether they would be beneficial or adverse. Beneficial impacts would improve resource conditions and adverse impacts would negatively alter or deplete resources.

Possible impacts to natural resources could include action that could:

- Exceed the adopted thresholds of environmental laws, or executive orders.
- Fail to conform to NPS Management Policies or Director's Orders.
- Affect a special status species or cause a net change into the habitat of the species.
- Change the ability of any resident or migratory fish or wildlife species to move.
- Cause any measurable changes in species composition or abundance of a community with special status.
- Cause change directly or indirectly to the stability of slopes or erodibility of soils within the Project Area or adjacent property.
- Alter hydrologic processes, shoreline process, water quality, wetlands or aquatic habitat.

Possible impacts to cultural resources could include actions that could:

- Fail to conform with NPS Management Policies or Director's Orders.
- Cause direct or indirect adverse effects to prehistoric or historic archaeological sites listed or eligible for listing on the National Register of Historic Places or the California Register of Historic Resources, or that contribute to a National Historic Landmark District or violate laws relating to archaeological and ethnographic sites.
- Change established recreational, educational, religious, or scientific uses of the Project Area.
- Alter aesthetic resources or viewshed in the project area.

Cumulative Context

The Council on Environmental Quality (CEQ) regulations implementing NEPA defines a cumulative impact as "…the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (CEQ Section 1508.7). The discussion of potential cumulative effects is included in the discussion of each impact topic. Overall discussion of cumulative impacts for the preferred project alternatives is found in Section 5.5.

Impairment of Park Resources
NPS Management Policies (NPS 2000) and NPS Director's Order 12, *Conservation Planning, Environmental Impact Analysis, and Decision Making,* require decision makers to consider impacts and determine in writing, whether a proposed action would lead to an impairment of park resources and values before approving the action.

The NPS Management Policies state: "The impairment that is prohibited by the Organic Act and the General Authorities Act is an impact that, in the professional judgment of the reasonable responsible NPS manager, would harm the integrity of park resources or values, including the opportunities that would otherwise be present for the enjoyment of those resources or values." The Management Policies further provide specific guidance for the NPS managers to use in analyzing whether a proposed action would result in impairment. The policy states that "…an impact would be more likely to constitute an impairment to the extent that it affects a resource or value whose conservation is:

- Necessary to fulfill specific purposes identified in the enabling legislation or proclamation of the park;
- Key to the natural or cultural integrity of the park or to the opportunities for the enjoyment of the park; or
- Identified as a goal in the park's general management plan or other relevant NPS planning documents." (NPS 2000 p. 12).

The Park resources and values that are subject to the no-impairment standard include the ecological, biological, and physical processes that created the Park and continue to act upon it.

A determination of impairment is made for each natural and cultural resource impact topic.

4.2 IMPACT ANALYSIS BY TOPIC

4.2.1. Geology and Soils

Policies and Regulations

As directed by NPS Management Policies, soil resources are subject to the "no impairment" clause that guides NPS decision-making to protect of the integrity of the important resources and values within the parks (NPS, 2000, §1.4.6). The NPS is directed to protect geologic features from the adverse effects of human activity, while allowing natural processes to continue (NPS, 2000, §4.1.5 and §4.8.2). Management action taken by the parks would prevent to the greatest extent possible the unnatural erosion, physical removal, contamination, and other potentially irreversible impacts to soil (NPS, 2000, §4.8.2.4).

Hydric soils, associated with wetland features such as bogs, marshes, and some wetlands, are afforded special protection by Executive Order 11990, Protection of Wetlands and the Clean Water Act Section 404 as regulated by the U.S. Army Corps of Engineers, and the State Regional Water Quality Control Board. Specific procedural guidance to NPS staff on the protection of wetlands and areas of hydric soils is outlined in Director's Orders 77-1, Wetland Protection. Assessment of potential impacts to hydric soils is addressed as a wetland impact in this document.

Within many areas of the park, the soil resources have been heavily manipulated through previous land uses including gravel extraction, road construction, grading, plowing, grazing, logging, etc. The soil resources in impacted areas have been previously disturbed. Activities conducted within these previously disturbed areas cannot restore natural soil horizon patterns, but can restore natural grades and improve the potential redevelopment of organic surface soils through actions such as topsoiling or revegetation.

Assessment Methodology

Point Reyes National Seashore contains a landscape including many areas that have been manipulated as part of historic agricultural, logging and development operations. In these areas, the historic soil horizons have been lost. Restoration activities are intended, not to restore historic soil horizons, but to restore the

physical and hydrologic conditions that will support development of natural soil horizons in the future. The other major aspect evaluated with soils is the current or future potential of erosion from a restored site. Evaluation of impacts will include consideration of previously disturbed versus stable soils and the potential for erosion associated with restoration activities.

Determination of Effect. The primary source for information on Seashore geology comes from Galloway 1977 and Clark and Brabb 1997. The primary source of information for soils is the 1985 Soil Conservation Service Soil Survey of Marin County.

Effects are analyzed based on the following categories:

Previously disturbed/not disturbed:
Much of the Point Reyes National Seashore land area has been disturbed through agricultural, logging or development activities. Areas where soil horizons have been totally removed through construction, road grading, quarrying activities, as well as major gullying are considered previously disturbed for the analysis of impacts. Where historic soil horizons remain intact, evaluation of impacts will consider other factors such as area of impact and erosive processes. Impact evaluation of areas already heavily disturbed, without intact soil horizons, will likely be considered negligible to minor.

Area of impact
Impacts associated with restoration or construction activities will be considered in the context of areal extent. Projects that will result in disturbance of more than five acres of land will likely result in moderate to major impacts. Projects that result in disturbance of less land will likely fall under the negligible to minor category.

Current erosion conditions/ potential for future erosion.
Many areas within the park, associated with old roads, historic land use, or gullying are currently large sources of sediment. Structures that have been constructed and currently store large volumes of material that are subject to mobilization under catastrophic failure have a high potential for current or future erosion. Evaluation of the project effects will also consider current or potential erosion without treatment in comparison with potential erosion expected with restoration activities. This will be evaluated essentially as a ratio, with conditions of 1:1 (erosion potential under current condition: erosion potential under future condition) or greater resulting in moderate to major impacts, and conditions of less than 1:1 considered negligible to minor.

Impact analysis of these three variables will provide basis for considering impact intensity associated with the project activities.

Type of Impact

Beneficial: Restores more natural topography and facilitates natural surface and groundwater hydrologic flow patterns. Protects or enhances properties of native soils and promotes or restores natural soil processes.

Adverse: Degrades the characteristics of native soils, exposes soils to accelerated rates of erosion, results in loss of native soils, or contributes to slope failure.

Duration of Impact

Short-term: Impacts are limited to the first two years after treatment.

Long-term Impacts persist beyond two years after treatment.

Intensity of Impact

Negligible: Small-scale project occurs on previously disturbed soil resources. No quantifiable impact and/or reasonably anticipated type of effect based on current knowledge of soil characteristics.

Minor: Project occurs on previously disturbed soil resources. There is potential for production of measurable erosion, but it can be contained within the project area with erosion control treatments. Activities do not aggravate erosion potential above current erosion conditions.

Moderate: Project includes large scale disturbance in occurs on previously disturbed soil resources. There is likely production of measurable erosion, but it is possible that sediment can be intercepted between the project area and sensitive waters. Erosion potential is increased above current erosion conditions.

Major: Project occurs on stable, and likely undisturbed soil resources. There is likely increased potential for catastrophic failure, with erosion directly into sensitive water resources. No actions are available to control or detain sediment away from sensitive waters. Maintains or creates unnatural processes.

4.2.2 Water Resources and Shoreline Process

Policies and Regulations

The Clean Water Act requires the NPS to "comply with all Federal, State, interstate, and local requirements, administrative authority, and process and sanctions respecting the control and abatement of water pollution." The NPS Freshwater Resource Management Guidelines (found in NPS-77) requires the NPS to "maintain, rehabilitate, and perpetuate the inherent integrity of water resources and aquatic ecosystems."

NPS Management Policies 2001 states the NPS should "re-establish natural functions and processes in human-disturbed components of natural systems in parks unless otherwise directed by Congress…..Impacts to natural systems resulting from human disturbances include the introduction of exotic species; the contamination of air, water, and soil; changes to hydrologic patterns and sediment transport; the acceleration of erosion and sedimentation; and the disruption of natural processes. The Service will seek to return human-disturbed areas to the natural conditions and processes characteristic of the ecological zone in which the damaged resources are situated. The NPS Management Policies also include direction related to the protection and restoration of shoreline process (Section 4.8.1.1) "Natural shoreline processes (such as erosion, deposition, dune formation, overwash, inlet formation, and shoreline migration) will be allowed to continue without interference. Where human activities have altered the nature or rate of natural shoreline process, the Service will… investigate alternatives for mitigating the effects of such activities or structures, and for restoring natural conditions."

Assessment Methodology

The following three primary aspects of water resources were assessed when considering potential impacts:

- Shoreline Process / Marine and Estuarine Resources,
- Aquatic Habitat,
- Salinity Regime, and
- Water Quality

Shoreline Process / Marine and Estuarine Resources refers to natural processes such as beach and wave dynamics, unimpeded tidal circulation, erosion, deposition, and maintenance of natural channel patterns. Aquatic habitat refers to the attributes that support or provide habitat within stream or pond systems. With respect to this project, a physical proxy for aquatic habitat condition and quality is water depth and water capacity. The salinity regime is evaluated specifically for this project. This is done because, though it is considered an estuarine resource (average salinity at low flow > 0.5 ppt), the site supports a breeding

population of the California red-legged frog. Water quality refers to the conditions necessary to support aquatic life within a lagoonal or tidally influenced system. Particular consideration was given to actions with potential to affect the natural hydrology, aquatic habitat features, and surface water quality of this estuarine resource.

The project involves change to the physical and hydrologic conditions within the project area. The intensity of impacts are evaluated within the local (project area) context, and the intensity of the contribution of effects to the cumulative impacts are evaluated in a regional context (Drakes Bay). The Horseshoe Pond area is one of many coastal lagoon features in the area that have been heavily influenced by human interaction. Current, restricted flow conditions result in degraded water quality conditions and excessive swings in dissolved oxygen. The water resources and shoreline process section is evaluated based upon the premise that naturally, the area would have functioned in a state of dynamic equilibrium with regard to natural hydrologic and shoreline process.

Type of Impact

Adverse: would alter or prevent the progress towards natural hydrologic and shoreline process (e.g., impede tidal flux, dynamic equilibrium); would maintain degraded water quality or impede progress towards improved water quality (e.g., increase pollution or bacteria levels from recreational use); or degrade aquatic habitat.

Beneficial: would restore natural hydrologic and shoreline conditions (e.g., remove impediments to flood flows, stabilize riverbanks, etc.); improve water quality (e.g., reduce non-point source pollution); or improve or maintain aquatic habitat.

Duration of Impact

Short-term: would persist two years or less.

Long-term: would persist longer than two years.

Intensity of Impact

Negligible: would be imperceptible or not detectable.

Minor: would be slightly perceptible and would be localized (i.e., would occur in the immediate vicinity of an action).

Moderate: would be apparent at the local scale and would be perceptible at the regional scale. The result of the impacts would have the potential to become larger.

Major: would be substantial, highly noticeable, and regional (i.e., The results of the impacts would expand beyond the immediate vicinity of an action).

4.2.3 Cultural Resources

Policies and Regulations

Section 106 of the National Historic Preservation Act requires Federal agencies to consider the effects of its actions on properties listed in, or eligible for inclusion in, the National Register of Historic Places (i.e., Historic Properties), and allow the Advisory Council on Historic Preservation a reasonable opportunity to comment.

Terms found in Section 106 of the National Historic Preservation Act are used to describe cultural resource significance and effects in this section. Each resource of interest is comprised of a set of attributes, called

significant characteristics, which lend importance to that resource. National Park Service guidance for implementation of NHPA Section 106 is documented in Director's Order 28 and the associated handbook.

Cultural Resource Impacts Defined

Under Section 106 of the NHPA effect categories for cultural resources: direct; operational; and indirect are utilized. Direct effects are those where the actions associated with the project are the cause of the impacts, operational effects occur as a result of associated operations like staging, while indirect effects are ones where the actions result in changes to local context such that cultural resources would be affected. As such, direct and operational effects for cultural resources are the equivalent of direct impacts under NEPA, while indirect effects on cultural resources correspond to indirect and cumulative impacts.

Different from NEPA, the Section 106 process considers only the adverse effects upon cultural resources, not potentially beneficial ones. An ordinal scale of impact intensity (negligible, minor, moderate, major) is also foreign to the Section 106 process - effects are either adverse (when the integrity of the historic property is diminished due to the undertaking) or they are not. Duration is not typically factored when assessing effects during the Section 106 process. These issues are considered in greater detail below in relation to direct, operational and indirect effects.

For the purpose of this evaluation, Section 106 effect categories are considered, and an ordinal scale of is used to qualitatively show impact intensity.

Assessment Methodology

Archeological Resources

Archeological research ranging from site survey to complex archeological excavations has taken place primarily from the early 1900s through the present. Thirty-two archeological sites on the Point Reyes peninsula were partially excavated from the 1940s through the 1960s by archeologists from the University of California at Berkeley, San Francisco State University, Santa Rosa Junior College, and the Drake Navigators Guild. Information gained from these excavations was critical in placing the Coast Miwok culture within local and regional chronologies and in gathering evidence of early Coast Miwok contacts with Drake and Cermeno.

An archaeological survey that identified two cultural resources within the Project Area was conducted by Anthropological Studies Center (ASC) staff in November and December of 2001. This technical report is referenced as An *Archaeological Study for the Pont Reyes Coastal Watershed Restoration Project, Point Reyes National Seashore, Marin County, California*, Michael Newland, 2004. Follow-up surveys to document the extent of the site MRN/394/H, allowing for planning to avoid impacts to archaeological site, were conducted on the site in 2002 and 2003. The ASC report also documents the very limited and fragmentary remains of either the SS Pomo or SS Shasta that washed to the former lagoon mouth prior to the dam construction. These remains are often submerged below the sand, but have been exposed in some winters by erosion of the beach.

The earthen dam was constructed in the later 1940s, though it has been determined by cultural resources staff that the dam structure is not significant to the cultural landscape of the ranch. Major maintenance and modifications to the dam were conducted from the 1950s through the late 1980s, and it has been determined by cultural resources staff that the structure is not historic. The potential for adverse impacts to cultural resources will be evaluated

The following measures are employed to assess impacts of the project on cultural resources. Further rationale for each measure is provided in discussions of direct, operational, and indirect effects that follow.

Type of Impact

Adverse: Changes to the significant characteristics of a resource of interest. These changes may be perceptible and measurable, or, in the case of certain archeological and ethnographic resources, imperceptible, and psychological.

Beneficial: Changes on or in the vicinity of a resource of interest such that the significant characteristics of the resource are protected against adverse impacts of restoration actions and/or restored to some desired condition.

Duration of Impact

Short-term Adverse: Changes that result in permanent or temporary loss of data potential in the significant characteristics of a resource of interest, but do not manifest for a period of 10 or fewer years following the restoration action.

Short-term Beneficial: Changes that afford protection to the significant characteristics of a resource of interest from restoration actions for a period of no more than 10 years.

Long-term Adverse: Changes that result in a permanent or temporary loss of data potential in the significant characteristics of a resource of interest, and manifest in more than 10 years following the restoration action.

Long-term Beneficial: Changes that afford protection to the significant characteristics of a resource of interest from restoration actions for a period of no more than 10 to 20 years.

Permanent Adverse: Changes that result in permanent loss of data potential in the significant characteristics of a resource of interest, and manifest immediately following the restoration action.

Permanent Beneficial: Changes that result in permanent protection to the significant characteristics of a resource of interest from restoration actions.

Intensity of Impact In this analysis, intensity of impact is measured relative only to adverse resource impacts.

Negligible: No or barely perceptible and changes to the significant characteristics of a resource of interest.

Minor: Perceptible and measurable changes to the significant characteristics of a resource of interest, but those changes do not inhibit interpretive potential and/or a minor percentage of the significant characteristics would be affected. Resources prone to impacts in this category might include archeological resources containing a high percentage of resources of interest with low vulnerability to the effects of restoration actions and/or possessing subsurface components.

Moderate: Perceptible and measurable changes to the significant characteristics of a resource of interest, but those changes do not inhibit interpretive potential and/or a moderate percentage of the significant characteristics would be affected. Resources prone to impacts in this category might include archeological sites containing a moderate percentage of resources of interest with low vulnerability to the effects of restoration actions and/or possessing subsurface components.

Major: Perceptible changes to the significant characteristics of a resource of interest, and those changes inhibit interpretive potential of a major percentage of the significant

characteristics. Resources prone to impacts in this category might include archeological sites containing a large percentage of resources of interest with high vulnerability to the effects of restoration activities.

4.2.4 Vegetation

Policies and Regulations

NPS Management Policies 2001 state "The National Park Service will maintain as parts of the natural ecosystems of parks all native plants and animals." The policies go on to state that the above statement includes flowering plants, ferns, mosses, lichens, algae, fungi, and microscopic plants. The NPS is to preserve and restore the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of these native species. Additionally, the NPS is to prevent the introduction of exotic (non-native) species into units of the National Park System (NPS Management Policies 2001: Section 4.4.4.2; ***Executive Order No. 13112)***. The policy manual NPS-77 (Natural Resource Management Guidelines) also provides general guidelines on vegetation management. Actions proposed in the *Restoration of Horseshoe Pond to Coastal Lagoon Environmental Assessment* include measures to prevent the introduction and spread of invasive species.

Assessment Methodology

Vegetation in the project area was digitally mapped using aerial photographs in 1999/2000. Field data on plant species composition were collected to characterize and classify plant communities delineated in the mapping effort. The classification describes the vegetation alliances and associations that occur in the study area, and was initially based on the classification system described by Sawyer and Keeler-Wolf. For purposes of this document, alliances and associations found in the project area have been grouped together into 10 broad vegetation classes that are described in Chapter 3 (Affected Environment). The alliances and associations that are grouped into a given vegetation class all share species with similar growth forms and structural attributes, thus it is assumed that they would respond similarly to treatments that would be applied under the FMP. The areal extent of each vegetation class within each FMU was derived from the Seashore's GIS.

The presence and abundance of non-native (or exotic) plants in the affected vegetation classes is an important consideration as many non-native plant species are stimulated to grow and reproduce as a result of fire or other disturbance. The presence of some non-native plant species can have substantial adverse effects on native vegetation, including the following:

- they can out-compete native plants for light, nutrients, water and growing space, which, in the worst case, can lead to extinction or local extirpation of rare plant species;
- they can degrade the quality of wildlife habitat by out-competing native food sources, or altering nesting or resting habitat; and
- they can disrupt the genetic integrity of native plants if crossbreeding occurs.

Type, duration, and intensity of vegetation impacts are described as follows:

Type of Impact

Adverse: decreases the areal extent or native species richness of a plant community, results in a plant community type conversion, or increases invasive non-native plant species abundance or richness.

Beneficial: increases the areal extent or native species richness of a plant community, or decreases invasive non-native plant species abundance or richness.

Duration of Impact

Short-term: would be measurable for two years or less.

Long-term: would be measurable for longer than two years.

Intensity of Impact

Intensity of impact was determined for the restoration activities by considering the degree to which such activities would affect the areal extent of plant communities, or would change the abundance or species richness of native or non-native plant species within plant communities.

Negligible: would result in no measurable changes in areal extent, or in native or non-native species richness within a plant community.

Minor: changes in areal extent, or in native or non-native species richness within a plant community would be measurable, and would affect less than 5% of the total extent of that plant community in the project area.

Moderate: changes in areal extent, or in native or non-native species richness within a plant community would be measurable, and would affect from 5 to 25% of the total extent of that plant community in the project area.

Major: changes in areal extent, or in native or non-native species richness within a plant community would be measurable, and would affect 25% or more of the total extent of that plant community in the project area.

4.2.4 Wetlands

Policies and Regulations

Wetlands are addressed separately from other vegetation types in this impact analysis as they are protected by a specific set of laws and regulations. Wetlands are lands that are transitional between terrestrial and aquatic systems, where the water table is usually at or near the surface, or the land is covered by shallow water. Wetlands buffer the effects of hydrologic and erosional cycles, influence biogeochemical cycles of nitrogen and other key nutrients, and create unique microclimates for animal and plant species.

Section 4.6.5 of the NPS Management Policies addresses the restoration of wetlands on NPS lands, "When natural wetland characteristics or functions [of wetlands] have been degraded or lost due to previous or on-going human actions, the Service will, to the extent practicable, restore them to predisturbance conditions" (NPS 2000).

The protection of wetlands within NPS units is facilitated through the following:

- Executive Order 11990, Protection of Wetlands.
- NPS Director's Order 77-1, Wetland Protection and Procedural Manual 77-1 (DO 77-1 and PM 77-1).
- Rivers and Harbors Act, Section 10.
- Clean Water Act, Section 404.
- The "no net loss" goal outlined by the White House Office on Environmental Policy in 1993.

Executive Order 11990 requires that agencies work to minimize the destruction, loss, or degradation of wetlands. Director's Order 77-1 and Procedural Manual 77-1 provide specific procedures for implementing Executive Order 11990. Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act authorize the U.S. Army Corps of Engineers to grant permits for construction and disposal of dredged material in waters of the United States, which includes wetlands.

Assessment Methodology

For this assessment, wetlands that could be subject to impacts were identified using the USFWS - Cowardin Method surveyed in the field (USFWS, 1984). These data layers then were overlain with the

boundaries of the project planning area. This information provided a conservative and broad estimate of the extent of known and potential wetlands within the planning area. The approximate number of acres that would be subject to impacts was estimated using the Seashore's GIS.

The parameters that were considered in the assessment of impacts on wetlands include the following:

- plant species composition of the wetland, including abundance and species richness of invasive non-native plant species;
- hydrologic features that maintain the wetland; and
- wetland soils.

These parameters parallel those used by the Army Corps of Engineers when defining wetlands. It is assumed that if these parameters are altered as a result of restoration activities, the wetland would be subject to impacts, which could be either beneficial or adverse.

Type, duration, and intensity of wetlands impacts are described as follows:

Type of Impact

Adverse: Shifts plant species composition to a higher percentage of non-wetland indicator species; alters hydrologic features/factors that are required to maintain the wetland; alters soil properties that are required to maintain the wetland; or reduces areal extent of wetlands.

Beneficial: Enhances or restores process necessary for wetland vegetation, soils, or hydrology to develop, or increases areal extent of wetlands.

Duration of Impact

Short-term: would be measurable for two years or less.

Long-term: would be measurable for longer than two years.

Intensity of Impact

Negligible: would result in no measurable changes in the areal extent of wetlands, or in wetland vegetation, soils, or hydrology.

Minor: changes in the areal extent, or in wetland vegetation, soils or hydrology would be measurable but would affect less than 5% of the total extent of the wetland type in the project area.

Moderate: changes in the areal extent, or in wetland vegetation, soils or hydrology would be measurable but would affect less than 20% of the total extent of the wetland type in the project area.

Major: changes in the areal extent, or in wetland vegetation, soils or hydrology would be measurable and would affect 20% or more of the total extent of the plant community in the project area.

4.2.5 Special Status Species

Policies and Regulations

Numerous species of plants and animals have undergone local, state, or national declines, which has raised concerns about their possible extinction if they are not protected. As a result, the U.S. Fish and Wildlife Service (USFWS) and the California Department of Fish and Game (CDFG) have established lists that reflect the species' status and the need for monitoring, protection, and recovery. In addition to federal and state-listed species, potential impacts on plants listed by the California Native Plant Society (CNPS) also

are considered for all programs and activities that the Seashore undertakes. The Seashore also recognizes a number of species as locally rare or of special concern, even though they are not officially listed. Collectively, species in all of these categories are referred to in this document as "special-status species."

The Federal Endangered Species Act (ESA) of 1973, as amended, requires federal agencies to consult with the USFWS before taking actions that (1) could jeopardize the continued existence of any federally listed plant or animal species (e.g., listed as threatened or endangered) or species proposed for listing, or (2) could result in the destruction or adverse modification of critical or proposed critical habitat. The USFWS provided upon request a list of species that must be considered for this EIS.

The Council of Environmental Quality Regulations for Implementing NEPA (Section 1508.27) also requires considering if an action may violate federal, state, or local laws or requirements imposed for the protection of the environment. For this reason, species listed under the California Endangered Species Act (i.e., those considered endangered or threatened) by the California Department of Fish and Game are included in this analysis. Species proposed for listing in either of the two categories are also included.

NPS Management Policies (NPS, 2000) state: "The National Park Service will identify and promote the conservation of all federally listed threatened, endangered, or candidate species within park boundaries and their critical habitats.... The National Park Service also will identify all state and locally listed threatened, endangered, rare, declining, sensitive, or candidate species that are native to and present in the parks, and their critical habitats.... All management actions for protection and perpetuation of special status species will be determined through the park's resource management plan."

Additionally, park managers are to ensure that park operations do not adversely impact endangered, threatened, candidate, or sensitive species and their critical habitats, within or outside the park and must consider federal and state listed species and other special-status species in all plans and NEPA documents (NPS-77 Natural Resource Management Guidelines).

NPS-77 states: "The following legislation, policies, and agreements provide the authority for NPS policies on management of threatened and endangered species: the Endangered Species Act; state-specific endangered species acts; other state wildlife statutes or agreements pursuant to Section 6, ESA; the Migratory Bird Conservation Act; the Fish and Wildlife Coordination Act; the Wild and Scenic Rivers Act; the Marine Mammal Protection Act; the Bald and Golden Eagles Protection Act; the Wilderness Act; the Convention on International Trade in Endangered Species; and maritime and other international agreements."

The USFWS normally takes lead Departmental responsibility for coordinating and implementing provisions of the Endangered Species Act for all listed endangered, threatened, and candidate species, particularly for all terrestrial plants and animals and freshwater aquatic species. However, for certain listed taxa such as *Cetacea* (all whales and porpoises), most *Pinnipedia* (Steller sea lions, Hawaiian monk seals, etc.), sea turtles, and anadromous fish (steelhead, coho salmon, etc), the NOAA Fisheries plays a very active role under provisions of both the Endangered Species Act (1973) and the Marine Mammal Protection Act (1972). For those marine species including fish it is often a case of shared USFWS\NOAA Fisheries responsibilities, with NOAA Fisheries frequently assuming the lead role.

The federal, state, and CNPS categories for special-status species are defined as:

- Federal endangered: Any species that is in danger of extinction throughout all or a significant portion of its national range.

- Federal threatened: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its national range.

- California endangered: Any species that is in danger of extinction throughout all or a significant portion of its range in the state.

- California threatened: Any species that is likely to become an endangered species with the foreseeable future throughout all or a significant portion of its state range.

- California rare (plants only): A native plant that, although not currently threatened with extinction, is present in small numbers throughout its range, such that it may become endangered if its present environment worsens.

CNPS List 1A:	Presumed Extinct in California
CNPS List 1B:	Rare or Endangered in California and Elsewhere
CNPS List 2:	Rare or Endangered in California, More Common Elsewhere
CNPS List 3:	Need More Information
CNPS List 4:	Plants of Limited Distribution

Assessment Methodology

Special Status Wildlife (including fish and other aquatic species)

The rich and productive ecological environment of Point Reyes National Seashore allows it to support habitat and use by 27 federally protected species. Within the Horseshoe Pond project area, three special status species are known to occur.

- California red-legged frog (*Rana aurora draytonii, FT)*
- pink sand verbena (*Abronia umbellata* ssp. *breviflora FSC*),
- marsh milkvetch (*Astragalus pycnostachyus* var. *pycnostachyus FSC)*
- San Francisco Bay spineflower *(Chorizanthe cuspidata* var. *cuspidata, FSC*)
- wooly headed spineflower (Chorizanthe cuspidata var. villosa, FSC)

With these factors in mind, the following parameters have been used to evaluate the effects on special-status animals of the various alternatives:

- The species affected and its degree of local, regional, nationally and global rarity.
- The rarity of the genotype or subspecies, regionally, nationally, or globally.
- The numbers of animals or proportion of the species range affected by the action.
- The response of the species to disturbance (if known), on a population or sub-population level.

Type of Impact

Adverse: Likely to result in unnatural changes in the abundance or distribution of a special-status species. This could occur through direct disturbance, mortality, or through destruction or alteration of habitat.

Beneficial: Likely to protect and/or restore the natural abundance and distribution of a special-status species. This could occur through protection and restoration of structure, successional state, or distribution of habitat.

Duration of Impact

Short-term: would result in immediate changes in the abundance and distribution of a special-status species, but a return to the original condition occurs within two generations of that species.

Long-term: would result in changes in the abundance and distribution of a special status species that persist for greater than two generations of that species.

Intensity of Impact

Negligible: would be imperceptible or immeasurable (undetectable).

Minor: would be slightly perceptible and localized in extent; without further actions, adverse impacts would reverse and the resource would recover.

Moderate: would be readily measurable (apparent) and extend further geographically than a minor impact, adverse impacts would eventually reverse and the resource would recover.

Major: would be substantial, highly noticeable, and affecting a large geographic area; changes would be irreversible with or without active management.

Special Status Plants

Special status species occur in the dune and wetland portions of the project area. These species are adapted to dynamic changes in water level and sand layers, and persist in such an environment. This type of dynamic equilibrium is impeded by the presence of the dam, as well as the non-native European beach grass. The factors associated with the protection of these species are to avoid the plants, where possible, otherwise insure that through the project there is no net loss to habitat. The following parameters have been used to evaluate the consequences of the various alternatives on special-status plants:

- The species affected and its degree of local, regional, national, and global rarity.
- The numbers of plants or proportion of the species range affected by the action.
- The response of the species to disturbance (if known).

Type of Impact

Adverse: would lead to loss or alteration of habitat, loss of individuals or populations of special-status plants, or reduction in reproduction.

Beneficial: would lead to increases in suitable habitat, an increase in areal extent or density of plants, or an increase in reproduction.

Duration of Impact

Short-term: would immediately affect the population or species, but would have no long-term effects to population trends or species viability.

Long-term: would lead to a loss in population or species viability - exhibited by a trend suggesting decline in overall species areal extent or abundance.

Intensity of Impact

Negligible: Imperceptible or note measurable (undetectable).

Minor: Small, measurable, perceptible and localized, without the potential to increase if left alone.

Moderate: Apparent, measurable, and sufficient to cause a change in the resources (e.g., abundance, distribution, quantity, or quality). Less localized than a minor impact.

Major: Substantial, highly noticeable, and with the potential for landscape-scale effects and major irreversible population effects.

4.3. IMPACTS ANALYSIS

4.3.1 ALTERNATIVE A - NO ACTION ALTERNATIVE

Under the No Action Alternative, current conditions and trends in Horseshoe Pond would remain unchanged. The majority of the dam would remain in place, although earthen material flanking the concrete spillway would continue to erode away. Erosive processes would facilitate restricted tidal exchange through the channel. The remainder of the earthen dam at the pond/beach interface would remain intact.

Impacts of the No Action Alternative
Under the No Action Alternative the physical impediments to natural hydrologic process in Horseshoe Pond would remain. Degradation of the unmaintained dam structure has resulted in a breach of the system, but in a location that prevents tidal and wave action from acting on the lagoon ecosystem. The current configuration supports highly degraded and unstable water quality conditions with dissolved oxygen ranging from 0 to >20 mg/l during summer days, and salinities ranging from 0.2 to more than 20 ppt seasonally. Wide variances in salinity and dissolved oxygen are known to limit benthic productivity in brackish habitats (Zedler 2001). These ranges are not tolerable by many species and likely prevent nearly all aquatic species (including aquatic invertebrates) from surviving in the pond year-round.

4.3.1.1 Soils and Geology

The access road leading down to the dam, including the quarry area has an inboard ditch that captures runoff and conducts it down the road. The road is deeply gullied, and delivers sediment directly to the western edge of the dam. Under Alternative A, these conditions would persist.

Cumulative Impacts
Under Alternative A, no cumulative impacts as a result of direct actions would result.

Conclusion
Alternative A would not meet the project objectives described in the Purpose and Need Chapter. The park was established by Congress to preserve and protect the diminishing coastline of the United States. Alternative A would maintain conditions that support continued erosion of road and dam facilities within the project area. The continued degradation is inconsistent with NPS management policies and project objectives. Alternative A would result in long-term, minor, adverse impacts to the estuarine condition in the project area from the continued erosion. Alternative A will not result in an impairment of park resources.

4.3.1.2 Water Resources and Shoreline Process

Under the No Action Alternative, the water level and salinities within Horseshoe Pond would remain driven by the same processes – ocean tide cycles, beach sand transport and delivery, and winter freshwater inflow. With the spillway failure in January 2002, the storage capacity of the pond would remain controlled by shoreline process. The salinity in the water body would vary based on winter runoff conditions and the summer barrier bar. The outlet would remain controlled by the dam and remnants of the spillway, to the east side of the valley. This is opposite of all other sand bar and lagoon interfaces within Drakes Bay.

4.3.1.2.1 Shoreline Process / Marine and Estuarine Resources

The water body would function as a quasi-lagoon with function impaired by the location of the outlet. The remains of the dam and control of the outlet to the east side of the valley would result in reduced hydrologic and tidal dynamics as well as ecological function. The current dam and outlet configuration impedes the formation of an outlet on the west side, and therefore development of natural shoreline process.

Without action, the remaining dam would constrain hydrologic function and the ability of the water body to function as either a pond or a lagoon. Because maintenance would not occur, the facility would continue to degrade, but at a rate incompatible with ecological response times.

4.3.1.2.2 Aquatic Habitat

Under Alternative A, no changes to the current annual and inter-annual depth fluctuations or water capacity of Horseshoe Pond as described in Section 4.1.2 are expected. Upstream land use (cattle grazing) has been substantially curtailed, resulting in reduced loading of sediment or nutrients to the system. Sediment now stored in the pond would remain, as the spillway configuration would continue to diminish strong flow dynamics that could have scoured the bottom of the pond/lagoon. Horseshoe Pond would remain at its current low storage capacity. Unless actions that would allow for scour of the bottom are introduced, late summer drying, such as that which occurred in 2002, would not be an uncommon phenomenon at this site in the future.

4.3.1.2.3 Salinity Regime

Under the No Action Alternative, no changes to the salinity regime are expected. The processes that control salinity levels (rainfall runoff patterns, tidal cycling, and beach sand accumulation) would continue. Monitoring has shown the water body to shift seasonally from nearly fresh (<1 ppt salinity) to highly saline (>20 ppt salinity). Since the spillway breach, the pond has also dried in late summer. Wide variances in salinity are known to limit benthic productivity in brackish habitats (Zedler 2001). Continued extreme variability of salinity, dissolved oxygen, and pond depth could limit both the availability and diversity of invertebrate prey for waterfowl and shorebirds in Horseshoe Pond. Annual precipitation and freshwater surface runoff primarily drive salinity levels within Horseshoe Pond, with drier years producing higher salinities and wetter years resulting in increased dilution and lower salinity levels.

4.3.1.2.4 Water Quality

Water quality is severely degraded under current conditions, resulting in documented fish kills related to dramatic shifts in dissolved oxygen. Under No Action, the poor water quality conditions are expected to continue. A lack of effective hydrologic circulation patterns within the waterbody would result in continued algal and zooplankton blooms. These conditions would keep the water body from functioning in a manner that is ecologically beneficial to the surrounding areas and species.

In the summer months, water quality conditions become seasonally degraded. Warm temperatures and high nutrient levels result in dramatic algal and zooplankton bloom and die-off cycles. Deployment of a recording Hach meter showed diurnal variation in dissolved oxygen during one of these bloom events to range from >20 mg/l during the daylight hours to 0 mg/l at night. This dramatic fluctuation in dissolved oxygen is typical of highly degraded systems and leads to die-off of gilled species. During the same summer, a fish kill of three-spined stickleback was observed, and was attributed to the same water quality conditions.

PRNS has conducted limited nutrient analysis in the system but none of the nitrate or orthophosphorus samples exceeded 5 mg/l. The water quality conditions of this system are subject to dynamic mixing and circulation that is currently restricted by the configuration of the outlet and beach process. It is likely that over a long period (>50 years) of time, the nutrients would be consumed and the system would establish an ecological balance. In the intervening years, the water quality conditions would remain degraded, including persistent algal and zooplankton bloom cycles in the summer leading to dramatic fluctuations in dissolved oxygen, and likely fish kill events.

Cumulative Impacts

Alternative A would not result in direct actions that change current water resources and shoreline processes. Therefore, alternative A will not result in cumulative impacts to these resources.

Conclusion

Alternative A would not meet the project objectives described in the Purpose and Need Chapter. The physical restrictions associated with the east-valley outlet would limit the ecological recovery of this estuarine/lagoonal system. The configuration and controls associated with the outlet restrict hydrologic process and the ability of the lagoon to function in a balanced state. The lagoon system evolved and functioned at a dynamic equilibrium until the dam was constructed. Despite the return of limited tidal interaction, the ability of the system to return to physical and ecological equilibrium is highly restricted. Because of these physical limitations, the water quality and estuarine conditions would remain degraded for a long period of time (>50 years). The capacity of the area to recover ecologically is directly linked to the presence of and time for a dynamic hydrologic equilibrium to return. Alternative A would likely result in long-term water quality conditions that prevent establishment of stable fish populations and limit macroinvertebrate productivity and thus, bird use. As a result, Alternative A would result in long-term (~50 years), moderate, adverse impacts to water resources, water quality and shoreline process.
As the management trajectory associated with Alternative A would not preclude the eventual restoration of dynamic equilibrium in the future, and the impact is restricted in effect, Alternative A would not result in an impairment of park resources.

4.3.1.3 Cultural Resources

Alternative A would maintain current wave action and circulation that has led to erosion of an archaeological resource site. This management alternative would result in the continued erosion of a documented archaeological resource site within the Project Area. The documented archaeological resource is threatened by erosion under the conditions that would persist under Alternative A. PRNS is working to stabilize eroding archaeological sites throughout the Seashore and the loss of sites through erosion is a major concern of the Federated Indians of Graton Rancheria. While it is difficult to define the current level risk to the site, under the No Action Alternative this area would remain a location of cultural resource management concern for the foreseeable future.

Cumulative Impacts
Under Alternative A, no cumulative impacts as a result of the project would occur to cultural resources.

Conclusion
Under Alternative A, the continued erosion of the documented site would result in moderate, long-term adverse impact to the cultural resources. The erosive processes are related to the existing hydrologic flow configurations, and would remain a persistent problem at this location.

Under Alternative A, the site would likely continue to erode and would therefore not meet the project objective : to protect stability of archaeological resource site CA-MRN-394/H. As Alternative A would not change the current condition of site CA-MRN-394/H, the alternative would not result in an impairment of park resources.

4.3.1.4 Vegetation

PRNS has an active invasive plant eradication and native plant restoration program that focuses on the most pressing exotic plant issues in the park. Alternative A would not foster the increased spread of invasive plants and does not pose a threat to spread invasive plants into more sensitive plant communities in the park. Under Alternative A, portions of the Project Area would continue to support non-native exotic plants but, due to the remoteness of the site, the populations would remain localized.

Cumulative Impacts
Under Alternative A, no cumulative impacts as a result of direct actions would result.

Conclusion
Under Alternative A, long-term, minor adverse impacts to native vegetation would continue due to the presence of non-native, invasive plants at the project site. An impairment of park resources or values associated with vegetation would not result from Alternative A.

4.3.1.5. Wetlands

Because no actions would be conducted under Alternative A, there would not be an impact existing wetlands within the Horseshoe Pond Project Area as described in Section 4.8. The recent natural changes to the hydrologic system, namely breach of the spillway area, have resulted in the conversion of submerged wetland resources into emergent wetland resources. Under Alternative A, the areal extent of wetlands would not change beyond the current conditions.

Although water quality conditions are degraded in the system, the wetland resources within the area have the required components, water regime, soils, and vegetation to support wetland habitat. The location and function are shaped by the existing dam facility. Under this alternative, all actions that result in the wetland function would remain unchanged.

Cumulative Impacts

Under Alternative A, no cumulative impacts as a result of direct actions would result.

Conclusion

No impacts to wetlands or impairment of park wetland resources would occur under Alternative A.

4.3.1.6 Special Status Species

4.3.1.6.1. Special Status Amphibians

California red-legged frog (CRLF) monitoring at the pond indicates that despite the considerable range in salinity during the summer months, the pond does support adults and limited egg mass distribution in the winter and spring months. The success of reproduction would remain highly dependent upon the winter rainfall and runoff patterns, as well as duration of runoff into the spring.

The Draft Recovery Plan for the CRLF reports that eggs exposed to salinity levels greater than 4.5 ppt experience 100 percent mortality and that larvae die when exposed to salinities greater than 7.0 ppt (USFWS 2000). Although Fellers and Guscio (2002) recorded a maximum salinity of 1.1 ppt, PRNS has observed salinity ranges from 0.1 ppt to 13.1 ppt during the environmental analysis of Horseshoe Pond, with CRLF present at all times. The egg mass surveys did not occur across a range of salinity levels (Fellers and Guscio 2002), and we do not have adequate information on breeding activity and success during periods when salinity levels are elevated in Horseshoe Pond. Based on the data in the Recovery Plan, it can be assumed that breeding success is lower during breeding seasons with high salinity, such as in 2001, when salinity levels between January and March ranged from 4.8 ppt to 9.9 ppt. Even under high winter salinity conditions, tadpoles have been observed with pond salinity at 8.6 ppt. (B. Ketcham, pers. com.).

Monitoring of Horseshoe Pond indicates that salinity levels vary in Horseshoe Pond from year to year. Annual precipitation and freshwater surface runoff primarily drive salinity levels within Horseshoe Pond, with drier years producing higher salinities and wetter years resulting in increased dilution and lower salinity levels (see Section 3.2.2.3). Based on these observations, NPS biologists believe that CRLF breeding success each winter has varied from year to year with the variance in salinity levels.

The dramatic shift in baseline water level from 2001 to 2002 exposed extensive mudflat areas that were formerly flooded by the pond. Vegetation has moved in and filled these open areas, resulting in more extensive habitat availability for breeding frogs.

Through a variety of surveys over the past decade, NPS and USGS-BRD scientists have documented the presence of CRLF breeding in more than 125 locations within PRNS. While the population observed at the Horseshoe Pond area is large, compared to other areas surveyed, the estuarine delineation of the pond and variable salinity levels observed both before and after the January 2002 dam breach, meant that frog reproduction at this site was already at great risk.

Unlike the action alternatives, Alternative B and C, Alternative A does not include the frog habitat enhancement project which would provide additional CRLF habitat that could replace some function and habitat values formerly provided at the Horseshoe Pond, without risk of failure or salinity intrusion.

Cumulative Impacts
Under Alternative A, no direct action would occur at the site. The restoration activities evaluated in conjunction with the Horseshoe Pond project include conversion of two areas currently freshwater, back to tidal activities. While the Horseshoe Pond supports the CRLF, the habitat is already considered estuarine under wetland and water quality definitions.

Under Alternative A, Horseshoe Pond would not contribute to cumulative impacts associated with other proposed NPS projects.

Conclusion
The current conditions at Horseshoe Pond would continue under Alternative A. No enhancement actions would be conducted at any other site to augment habitat availability in this area. For these reasons, Alternative A would result in minor, long-term, adverse impacts to the California red-legged frog, federally-listed as a threatened species under the Endangered Species Act. Horseshoe Pond represents one of 120 known breeding areas in the park, and the pond would continue to provide the existing quality of breeding and foraging area. While observed frog numbers have declined, there is still use of the area for breeding. Because this is not the only site in the park supporting the CRLF, and there is known breeding in other adjacent areas, Alternative A would not result in impairment of park resources or values associated with amphibians protected under the Endangered Species Act.

4.3.1.6.2. Special Status Plants

No direct actions would occur in the project area under Alternative A. This alternative would not result in direct disturbance to the habitat of special plant species such as pink sand verbena (*Abronia umbellata* ssp. *breviflora*), San Francisco Bay spineflower *(Chorizanthe cuspidata* var. *cuspidata, FSC*)*,,* wooly headed spineflower (Chorizanthe cuspidata var. villosa, FSC), and marsh milkvetch (*Astragalus pycnostachyus* var. *pycnostachyus*).

As described in Section 3.2.6.2, declines in pink sand verbena have occurred throughout its range, due to impacts such as vehicles, non-native plants, and foot traffic (CNPS 2001). The current dam configuration results in a more stable beach and dune feature allowing for colonization by non-native European beach grass. This species is adapted to dynamic shoreline process that is restricted under the current setting.

Cumulative Impacts
At present, the dune restoration project is not scheduled to address potential sites within the Drakes Bay watershed. Under Alternative A, no cumulative impacts would occur as a result of direct actions.

Conclusion
Alternative A would have no direct effect on special status plant species within the project area but continued spread of European beach grass within Point Reyes National Seashore could eventually displace the dune habitat supporting special status plants. Alternative A would have a minor, long-term adverse effect on special status plant species but would not constitute an impairment of park resources.

4.3.1.6.3. Other Special Status Species

Northern elephant seals, especially sub-adult males, would continue to use the area as a haul-out during the breeding season. Special status birds, such as the brown pelican, would continue to use Horseshoe Pond for feeding and resting. The western pond turtle can tolerate brackish water and would continue to use the project area for nesting. The host plant for the Mrytle's silverspot butterfly is found in the Horseshoe Pond watershed but was not identified within the project area. Rare

sightings of the butterfly have occurred in the watershed. No other special status species are known from the project area, nor likely to move into the project area due to the poor quality of aquatic habitat of the pond.

The project area has been identified as a potential site for the experimental reintroduction of the tidewater goby as part of the recovery planning effort (Jacobs 2004 personal communication). The existing water quality (large fluctuation in dissolved oxygen) and water regime (drying conditions in late summer) would not support such an activity.

Cumulative Impacts
Under Alternative A, no cumulative impacts would occur to other special status species as a result of direct actions.

Conclusion
Alternative A would have no effect on other special status species within the project area and no impairment of park resources could result.

4.3.2. ALTERNATIVE B - SPILLWAY REMOVAL AND HABITAT ENHANCEMENT

Alternative B would remove only the concrete spillway and associated berm spanning the pond outflow, allowing enhanced tidal exchange through this channel and facilitating movement of aquatic species in and out of the system. Removal of the spillway would also eliminate a cement structure and debris from this area of Drakes Beach. Although Alternative B would facilitate tidal access into Horseshoe Pond, restoration activities would be restricted to a location that naturally impedes tidal and wave action from effectively acting on the lagoon ecosystem. Under Alternative B, PRNS proposes to regrade and replant the former D-Ranch waste lagoon (Enhancement Site) to enhance potential for successful use of the pond as breeding habitat for the California red-legged frog.

4.3.2.1 Soils and Geology

The project would wholly occur on soils that were previously disturbed during the construction of Horseshoe Pond and does not currently constitute a native soil horizon. In addition, the soils within the project area do not qualify as prime farmland soils and are not integral to long-term agricultural activities in the region. There may be some soil loss or soil compaction during project implementation as the earthen berm and spillway are removed and the stock pond is regraded and revegetated.

Soils and debris excavated from the spillway area would be transported to the D-Ranch complex and stockpiled and contained within the building complex area. Construction activities associated with the enhancement site would result in regrading of existing disturbed materials on site.

Topsoil supporting a native seedbank would be recovered from grading areas and stockpiled for spread across the regraded area following restoration. The topsoiling activities are intended to innoculate the soils and facilitate regrowth of the natural seedbank.

Cumulative Impacts
Under Alternative B, short term impacts to previously disturbed soils would occur within the project area. The pond enhancement site is identified as an isolated wetland resource and will not be evaluated as part of the cumulative impacts analysis. Because the natural soil horizon in the project area has already been highly altered, the activities associated with this project would not contribute to cumulative soil resource impacts within the Seashore.

Conclusion
Under Alternative B, minor, long-term, beneficial impacts to soils and topography would result from removal of the spillway and regrading activities of the enhancement pond area. No actions would occur on the eroding road, quarry, or dam facilities. As the project area is located within and contributes to a highly altered landscape and altered soil conditions, no impairment of soil resources would occur.

4.3.2.2 Water Resources and Shoreline Process

Under Alternative B, only the cement spillway and associated fill would be removed from the site. This would partially change the hydrologic condition or regime from its current status by increasing tidal intrusion into Horseshoe Pond. The storage capacity of the pond would remain at a volume controlled by the beach sand bar. The salinity in the water body would vary in association with winter conditions and the summer barrier bar. The outlet would remain on the east side of the valley (down current), which is counter to all other sand bar and lagoon interfaces within Drakes Bay.

Alternative B includes regrading and planting of riparian vegetation around the Enhancement Site (the former D-Ranch lagoon facility) to improve habitat value and function for the California red-legged frog. Due to its location (on the ridge of a hill), land use (protected as natural zone), construction (excavated pit), and watershed area (pond derives only rainfall), it is expected that this water body would persist without maintenance for the indefinite future.

4.3.2.2.1 Shoreline Process / Marine and Estuarine Resources

Under Alternative B, only the cement spillway and associated fill would be removed from the site. This action would not significantly change the hydrologic conditions and shoreline process from the current status described under Alternative A. The water body would function as a quasi-lagoon with function impaired by the location of the outlet. The remains of the dam and control of the outlet to the east side of the valley would result in reduced hydrologic and tidal dynamics as well as ecological function. Current monitoring has shown the water body to shift from nearly fresh (<1 ppt salinity) to highly saline (>20 ppt salinity) on a given high tide cycle. Very few species are adapted to survive the severe range in salinity that has been observed in Horseshoe Pond. Removal of the cement spillway would leave the earthen berm, the primary constraint to hydrologic function.

Treatment at the Enhancement Area site would not affect Marine and Estuarine Resources.

4.3.2.2.2. Aquatic Habitat

Some hydrologic flow patterns, depth, and water capacity would not change beyond the conditions described under Alternative A, and therefore, Alternative B would not significantly change the condition or extent of aquatic habitat within the project area.

The restoration actions proposed at the former waste lagoon (red-legged frog enhancement site) would dramatically improve the extent and condition of aquatic habitat at this site. Currently, steep slopes and non-native weeds dominate the highly nutrient loaded system. Regrading steep banks and planting riparian vegetation would diversify the aquatic habitat at the site.

4.3.2.2.3. Salinity Regime

Despite the potential for further saltwater intrusion by removing the concrete spillway, the salinity in Horseshoe Pond would remain balanced by the interactions of freshwater run-off and ocean driven high tides and storm surges. Because Horseshoe Pond is set back from the beach, salt water is unlikely to penetrate the entire lagoon during high tides and winter storm events following restoration. Instead the saltwater would reach into the lower ends of the lagoon and then get mixed throughout by wind driven circulation processes. In years with high rainfall, the freshwater outflow from Horseshoe Pond would increase dilution, keeping salinity levels low. This was the case in the winter of 2002, when ocean water flowed into Horseshoe Pond following partial failure of the concrete spillway. Despite periodically elevated salinity levels up to 8.4 ppt near the concrete spillway, the remainder of the pond remained at low salinity levels near 0.3 ppt. High rainfall and freshwater runoff kept Horseshoe Pond at low salinity, despite an ocean connection at the concrete spillway.

No salinity impacts would occur at the red-legged frog enhancement site.

4.3.2.2.4. Water Quality

The hydrologic configuration would continue to restrict tidal circulation and flushing of Horseshoe Pond resulting in continued poor water quality conditions within the system. Without completely effective hydrologic circulation patterns, algal and zooplankton blooms would occur periodically, likely resulting in fish kills related to dramatic shifts in dissolved oxygen. These phenomena would keep the water body from functioning in a manner that is ecologically beneficial to the surrounding areas and species.

Treatment at the Enhancement Site would improve habitat conditions and water quality within the former waste lagoon. Currently the pond embankment is completely covered in non-native weed species, and provides no structure or habitat to the pond area. Proposed restoration would add cover and structure to the pond, improving water quality conditions in the system.

Cumulative Impacts

The actions proposed under Alternative B are limited, including the excavation of 90 cubic yards of material and enhancement actions in the former waste lagoon at D-Ranch. These actions, in combination with other projects would not result in cumulative impacts to water resources within Drakes Bay.

Conclusion

Alternative B would partially meet one objective described in the project Purpose and Need -- to return the pond vicinity to a more natural appearing state by removing prominent evidence of construction (e.g. cement spillway feature and limited fill). The physical restrictions associated with the east-valley outlet would limit the ecological recovery of this estuarine/lagoonal system. The actions proposed under Alternative B would remove the cement structure, but not otherwise change the hydrologic conditions at Horseshoe Pond described under Alternative A. The configuration and controls associated with the outlet restrict hydrologic process and the ability of the lagoon to function in a balanced state would remain as they would under Alternative A. Because of these physical limitations, the water quality and estuarine conditions would remain degraded for a long period of time (>50 years). The capacity of the area to recover ecologically is directly linked to the presence of and time for a dynamic hydrologic equilibrium to return. The continuation of limited hydrologic function, degraded marine and estuarine resources, and degraded water quality conditions within the project would result in long-term, moderate adverse impacts to hydrology and water resources under Alternative B.

The enhancement activities proposed at the former D-Ranch waste lagoon would result in short-term, minor adverse impacts to the impacts, but the activities would result in beneficial long-term impacts to the site through facilitation of a healthy aquatic ecosystem at this site. Removal of the cement facilities would improve the site aesthetics, but would not dramatically alter the long, slow trend towards recovery. Because the management trajectory associated with Alternative B would not prevent the development of dynamic equilibrium over time and Alternative B includes the enhancement site to enhance freshwater aquatic habitat for the California red-legged frog, this alternative does not result in impairment of water resources.

Work conducted under this alternative would require Clean Water Act Section 401 certification from the Regional Water Quality Control Board for water quality related issues.

4.3.2.3. Cultural Resources

Alternative B would only address structures or components of structures constructed in the 1980s. The spillway was constructed in 1988, while the waste lagoon facility (Enhancement Site) was constructed in 1982. Neither of these features is considered historic, nor integral to the historic landscape of the facility.

The documented archaeological resource is threatened by erosion under the conditions that would persist under Alternative B. The Seashore has worked with the Federated Indians of Graton Rancheria to identify and protect other archaeological resources from erosion through construction of fencing. The level of risk

to the cultural resource site from continued erosion is difficult to define, however, this area would remain a location of cultural resource management concern for the long-term.

Cumulative Impacts
The actions proposed under Alternative B would not result in direct impacts to known cultural resources within the project area. These actions, in combination with other projects would not result in cumulative impacts to cultural resources within Drakes Bay.

Conclusion
Under Alternative B, actions to remove the cement dam and fill would avoid, and therefore not impact archaeological resources at the site. However, the continued erosion and potential loss of the documented site would result in a minor, long-term adverse impact to cultural resources at PRNS. The erosive processes are related to the existing hydrologic flow configurations, and would remain a persistent problem at this location. This alternative would not meet the project objective to protect stability of archaeological resource site CA-MRN-394/H. Despite avoiding direct impact to known cultural resource sites, maintenance of the current hydrologic configuration would not protect the stability of the site. As Alternative B does not propose actions that would accelerate degradation or change current condition of site CA-MRN-394/H, it would not result in an impairment of park resources. The potential loss of the site due to erosion would not be considered an "impairment" (NPS 2001a)

No cultural resources are identified at the Enhancement Site and treatment would not effect known cultural resources.

4.3.2.4. Vegetation

Vegetation types that would be affected by restoration activities under Alternative B include coastal salt marsh, coastal brackish marsh, coastal dunes, coastal prairie, upland and coastal scrub. Dominant species associated with these habitat types are incorporated in the Horseshoe Pond Botanical Survey Report. Plant species specifically occurring in wetland habitats are further found in the Horseshoe Pond Wetland Delineation Report.

Because the earthen berm flanking the concrete spillway would be permanently removed from the Project Area, this is the only area where permanent impacts to vegetation would occur. Heavy equipment may impact an area of approximately 0.27-acres at the spillway facility. Of this, approximately 0.12 acres is considered upland, consisting primarily of non-native grasses and shrubs, as well as the area of the cement spillway. This berm is a narrow band of non-native habitat with the underlying soil consisting entirely of fill material. Species that have become established on the berm are mostly non-native grasses. With coastal salt marsh occurring on the oceanside of the berm and coastal brackish marsh on the pond side, soil left exposed following removal of the earthen berm would be readily colonized by wetland plant species, including *Distichlis spicata* (saltgrass), *Juncus lesueurii* (rush), and *Eleocharis macrostachya* (spikerush). All work would be conducted off of existing berm facilities. This is intended to minimize the potential impacts to adjacent wetland habitats. Areas left bare by excavation would be at or below surrounding marsh grade. These impacts would not, however, be permanent and plant species are expected to readily re-colonize exposed areas naturally.

Vehicle traffic would also impact plants along the access road down to the spillway site. The majority of the old ranch road leading to Horseshoe Pond is in coastal prairie habitat, but is dominated by non-native grasses and forbs. Coastal scrub habitat has closed in on the road between the quarry and the pond. *Baccharis pilularis* (coyote brush) and *Rubus ursinus* (California blackberry) would need to be mowed back to allow for the passage of vehicles. Equipment would pass through coastal prairie habitat, coastal scrub, and some patches of coastal dune habitat along the berm flanking the southern shore of Horseshoe Pond. Coastal dune habitat occurs along the final part of the access road where wind has swept sand up onto the earthen berm.

Development of the CRLF Enhancement Site would include removal of non-native weed species and sprigging/planting of willow, typha (cattail), bulrush and other native riparian vegetation.

Cumulative Impacts
The actions proposed under Alternative B are limited, including the excavation of 90 cubic yards of material and enhancement actions in the former waste lagoon at D-Ranch. The activities associated with Alternative B would include mowing native vegetation and regrading of the enhancement area consisting primarily of non-native vegetation. The dune restoration project does not include Drakes Bay within the project area. Alternative B would not result in cumulative impacts to vegetation resources within Drakes Bay.

Conclusion
The actions proposed under Alternative B would result in minor short-term and beneficial long-term impacts on vegetation within the project area due to rehabilitation of the CRLF Enhancement Site. No impairment of vegetation resources or values would result.

4.3.2.5. Wetlands

Under Alternative B, wetlands at the spillway facility and enhancement site would be impacted by restoration activities. All activities would involve the excavation of materials from the site. No fill would be added to any of the areas identified as wetlands. Heavy equipment would conduct excavation activities from the existing berm. The material would be loaded into a dump truck and hauled up to the main D-Ranch complex. A silt or construction fence would be installed to delineate the approximately 0.27-acre work area, and excavation would mostly be limited to the fill and area immediately surrounding the fill. Wetland impacts are characterized with regard to the US Army Corps and Cowardin wetland delineation methods.

The project would likely be permitted under Nationwide 27, for restoration activities in wetland areas. The project intent and actions are intended to restore habitat and conditions supporting natural wetland features.

Corps Wetlands
Actions identified under Alternative B would result in the excavation of 90 cubic yards of fill, composed of cement and soil, from the current spillway and berm (Figure 18). Heavy equipment use would impact an area of approximately 0.27-acres at the spillway facility. This includes a total of 0.09 acres of tidal wetlands and 0.06 acres of tidal waters. This fill would be removed to the D-Ranch facility and stockpiled at that location for use by PRNS maintenance staff in the future. The excavation at the spillway site would result in the expansion of tidal wetlands and/or tidal waters by 0.12 acres within the project area.

Within the 2.05-acre enhancement site, the Corps confirmed the presence of 0.36 acres of non-jurisdictional isolated waters and 0.52 acres of non-jurisdictional isolated wetlands. Enhancement plans for the site would not result in the placement of any fill in this area. The regrading of slopes surrounding the former waste lagoon would likely expand the extent of both isolated waters and isolated wetlands within the enhancement site.

Cowardin Wetlands
Heavy equipment use would impact an area of approximately 0.27-acres at the spillway facility (Figure 18). Within the impacted area is approximately 0.09-acres of wetland type E2EMPh (Estuarine Intertidal, Emergent, Irregularly Flooded, diked/impounded), 0.04-acres of wetland type E2SBPh (Estuarine Intertidal, Unconsolidated Shore, Irregularly Flooded, diked/impounded), and 0.02-acres of wetland type E1UBLh (Estuarine Subtidal, Unconsolidated Bottom, Subtidal, diked/impounded). Wetland vegetation would subsequently recolonize the disturbed areas.

The Enhancement Site totals 2.05 acres, including the pond, shoreline, and access in and out of the site (Figure 19). Within this site are approximately 0.16-acres of wetland type PEMCh (Palustrine Emergent, Seasonally Flooded, diked/impounded), 0.56-acres of wetland type PUBChx (Palustrine, Unconsolidated Bottom, Seasonally Flooded, diked/impounded, excavated), 0.09-acres of wetland type PUBHhx (Palustrine, Unconsolidated Bottom, Permanently Flooded, diked/impounded, excavated), and 0.01 acres of

wetland type PUBFhx (Palustrine, Unconsolidated Bottom, Semi-permanently Flooded, diked/impounded, excavated). Expanded descriptions of these wetland types at the Enhancement Site may be found in the Horseshoe Pond Wetland Delineation Report. Implementation at the CRLF enhancement site would be expected to permanently convert PUBChx and PUBFhx wetland types to PUBHhx wetlands for a total of approximately 0.66-acres of PUBHhx wetlands available as CRLF habitat. Regrading of the pond levees would result in lower gradient slopes. Some wetland vegetation, including willows, typha and bulrush would be collected from adjacent watershed areas and propagated at appropriate locations within the restored pond area. These plantings would initiate colonization along the margins of the pond.

Cumulative Impacts

The actions proposed under Alternative B would result in the restoration of < 1acre of jurisdictional tidal waters and wetlands, as well as isolated waters and wetlands, and Cowardin intertidal emergent and palustrine emergent wetlands to the area. The work would be limited to excavation in the spillway area, and work in the enhancement area is on isolated wetland resources. This would result in a net gain of wetlands to the Drakes Bay area. Construction activities associated with Alternative B would result in temporary impacts, but not fill to wetland resources. Access to the work area would be achieved through upland roads and existing dam and berm facilities. The pond enhancement site is identified as an isolated wetland resource and is not evaluated as part of the cumulative impacts analysis.

Evaluation of cumulative impacts considers all projects anticipated within the Drakes Bay area in the foreseeable future. The intent of all projects is to remove physical structures that impede natural hydrologic and/or shoreline process. Excavation of fill from wetland areas would result in expansion of wetland habitat. The short-term impacts to wetlands are considered minor within the project area, and negligible to the Drakes Bay area. In the long-term, the actions under Alternative B would result in expansion of wetlands to the project area and Drakes Bay, and is considered beneficial.

Conclusion

The actions proposed would result in direct impacts leading to areal expansion of US Army Corps jurisdictional tidal waters, tidal wetlands, isolated waters and isolated wetlands. In addition, the actions proposed under this alternative would result in expansion of estuarine intertidal emergent and unconsolidated bottom wetland types in the spillway area, and likely conversion and addition of palustrine emergent flooded and seasonally flooded wetland resources in the enhancement area. This Alternative would result in minor adverse short-term impact following construction and minor beneficial long-term impact on wetland habitat within the project area. Based on this assessment, Alternative B would not result in impairment of park resources or values related to wetlands. Work conducted under this alternative would require permits from the US Army Corps (Clean Water Act Section 404) and a coastal consistency determination/Coastal Permit from the California Coastal Commission for work in the wetland resource areas. An NPS Wetland Statement of Findings is not required in cases when there is no long-term loss of wetland area. The park seek concurrence with the NPS Water Resources Division in conjunction with USACE and California Coastal Commission wetland permits.

4.3.2.6. Special Status Species

4.3.2.6.1. Amphibians

Alternative B would result in minor change to the hydrologic regime documented under Section 3.2.2 and Alternative A. In addition, Alternative B includes enhancement of conditions at an adjacent site dedicated as habitat for the CRLF. The removal of the spillway obstructions would allow for minor increases in tidal circulation within Horseshoe Pond and would reduce the possibility of drying events. Monitoring indicates that the conditions effecting the persistence and productivity of California red-legged frogs (CRLF) at Horseshoe Pond is the hydrologic regime and shoreline process, and their effects on salinity and water storage duration.

Following restoration activities under Alternative B, salinity levels and CRLF breeding success would continue to vary interannually. In years with high rainfall, the freshwater outflow from Horseshoe

Pond would increase dilution, keeping salinity levels low and the potential for successful CRLF breeding high, as was the case in the winter of 2002 (Section 3.2.2.3). In years when freshwater run-off is not enough to counterbalance tidal intrusion into Horseshoe Pond, salinity levels would increase and perhaps temporarily lessen CRLF breeding success.

Restoration activities conducted under Alternative B would not change existing hydrologic and salinity regimes to an extent that would impact CRLF population at Horseshoe Pond. As such, CRLF breeding potential would continue to be enhanced during years with high rainfall and reduced during dry years. Activities under Alternative B are not likely to create permanently unsuitable breeding habitat for CRLFs in Horseshoe Pond.

Alternative B would also include restoration of habitat for the CRLF at the Enhancement Site. This pond covers more than one acre. As it was constructed for waste storage, the banks are very steep and covered by non-native weeds. Regrading of these banks would enhance the pond edge habitat, creating areas where emergent vegetation may establish, as well as more hospitable upland non-breeding habitat and refugia.

Cumulative Impacts

The actions proposed under Alternative B would not change the water regime within Horseshoe Pond to the extent that habitat quality or condition for the CRLF would be different from existing conditions. In addition, Alternative B includes the enhancement of a former waste lagoon as more suitable frog and aquatic habitat, thereby expanding habitat.

The actions proposed under Alternative B would not, in combination with other restoration projects in the Drakes Bay Area, not jeopardize the persistence of California red-legged frogs in the area.

Conclusion

Alternative B would not dramatically change hydrologic conditions or effects to the CRLF within Horseshoe Pond beyond those described under Alternative A. Within Horseshoe Pond, Alternative B would result in moderate, long-term, adverse impacts to the California red-legged frog, federally-listed as a threatened species under the Endangered Species Act.

Alternative B does provide additional enhancement habitat for the CRLF through the restoration of a former waste lagoon near the D-Ranch Complex. This would enhance more than an acre of aquatic habitat that may be used by the CRLF, adjacent to the existing habitat. Activities conducted at the Enhancement Site would result in moderate short-term impacts, but beneficial long-term impacts to special status amphibians. Horseshoe Pond is one of 125 known breeding areas in the national park. Under Alternative B, the pond would continue to provide the existing quality of breeding and foraging area and a former waste lagoon would be improved to provide habitat for the CRLF. As a result, Alternative B would not result in impairment of park resources or values associated with species listed under the Endangered Species Act.

4.3.2.6.2. Plants

Access to the concrete channel would pass along the earthen berm in extremely close proximity to the pink sand verbena (*Abronia umbellata* ssp. *breviflora*) population, San Francisco Bay spineflower *(Chorizanthe cuspidata* var. *cuspidata, FSC*), and wooly headed spineflower (*Chorizanthe cuspidata var. villosa, FSC*). The population has been marked in the field and would be avoided during construction. Temporary fencing material would be used to delineate the boundary of the population and ensure that machinery traffic would not jeopardize the persistence of rare plants at the site.

The two marsh milkvetch plants (*Astragalus pycnostachyus* var. *pycnostachyus*) located near the concrete spillway are located outside of the disturbance footprint of this area and would not be impacted by restoration activities.

There are no special status plant species located at the CRLF enhancement site.

Cumulative Impacts
Under Alternative B, construction activities would avoid areas where the special status plant species have been documented. Surveys conducted on sites associated with the projects evaluated for cumulative impacts do not contain the pink sand verbena, San Francisco or wooly-headed spineflower species or the marsh milkvetch. This project, in conjunction with planned projects within the Drakes Bay watershed will not result in impacts to the special status plant species known to occur at the project site.

Conclusion
Spillway removal activities would avoid direct impacts to sensitive plant locations; Alternative B would not affect special status plants occurring within the project area or result in an impairment of park resources. Habitat for western pond turtle could be expanded with the addition of the Enhancement Site.

4.3.2.6.3. Other Special Status Species

Impacts to other special status species would be similar to the effect described in Alternative A. The CRLF Enhancement Project could have a long-term beneficial impact on western pond turtle by providing additional breeding habitat following restoration of the waste lagoon.

The project area has been identified as a potential site for the experimental reintroduction of the tidewater goby as part of the recovery planning effort (Jacobs 2004 personal communication). The removal of the cement spillway will only negligibly change the hydrologic regime. The hydrologic regime under Alternative B, would likely include large fluctuation in dissolved oxygen and drying conditions in late summer. These conditions would not be conducive to an experimental population establishment.

Cumulative Impacts
Activities conducted under Alternative B may result in negligible impacts to other special status species. Therefore, under Alternative B, no cumulative impacts would occur to other special status species as a result of direct actions.

Conclusion
Alternative B would result in negligible short-term impacts and beneficial long-term impacts on special status species within the project area and would not result in an impairment of park resources or values.

4.3.3 ALTERNATIVE C – REESTABLISHMENT OF NATURAL HYDROLOGIC AND SHORELINE PROCESS WITH HABITAT ENHANCEMENT (RECOMMENDED AND ENVIRONMENTALLY PREFERRED ALTERNATIVE)

The actions proposed under Alternative C are intended to restore natural hydrologic and shoreline process to the project area, as well as enhance facilities that would act as alternative breeding habitat for the California red-legged frog. Alternative C also includes removal of the spillway facility, restoration of the quarry, and close-out of the road leading to Horseshoe Pond. Opening the outlet to the western side of the valley would allow for natural tidal and wave action to act on the lagoon ecosystem in a way that is consistent with ocean currents and sand transport patterns. The beach interface would maintain and control water level and hydrologic process within the Horseshoe Pond area. The salinity of the water body would vary in association with winter conditions and the summer barrier bar. Restoration of the lagoon outlet to the historic location would provide this lagoon with a hydrologic configuration that is consistent with all other sandbar-controlled outlets and spits in the Drakes Bay area. This alternative uses physical and archaeological information to restore a more naturally functioning hydrologic condition that is expected to improve estuarine/lagoon function and water quality, while establishing a salinity and water regime that functions in a manner that is compatible to aquatic organisms. In addition, the proposed change in hydrologic configuration would likely relieve erosion pressure on the archaeological site (CA-MRN-394/H) in a manner that may result in preservation and protection, without armoring or other treatments.

Alternative C includes regrading and planting of riparian vegetation around the Enhancement Site (the former D-Ranch lagoon facility) to improve habitat value and function for the California red-legged frog. Due to its location (on the ridge of a hill), land use (protected as natural zone), construction (excavated pit), and watershed area (pond derives only rainfall), it is expected that this water body would persist without maintenance for the indefinite future.

Alternative C would restore natural process, allowing for the ecosystem to move towards the state of dynamic equilibrium that persisted in the area until the construction of the dam.

4.3.3.1 Soils and Geology

The project would wholly occur on soils that were previously disturbed during the construction of Horseshoe Pond and does not currently constitute a native soil horizon. In addition, the soils within the project area do not qualify as prime farmland soils and are not integral to long-term agricultural activities in the region. There may be some soil loss or soil compaction during project implementation as the earthen berm and spillway are removed, the quarry is rehabilitated, former ranch roads and stock ponds are revegetated.

The quarry would be scarified and recontoured using a bulldozer and excavator. Material excavated from the dam would be compacted at the quarry site and recontoured to surrounding slope conditions. Fill would be placed using eight-inch lifts and compacted with the tracks of the bulldozer. A water truck may be required to meet compaction requirements.

Additional material would be compacted on the inboard side of the roadbed using the bulldozer. Finish work would be conducted by an excavator. The fill portion of the road prism would be excavated and spread over the top of the newly placed road fill. Topsoil recovered from the dam area and the road side cast would be spread over the newly recontoured area. The topsoiling is intended to inoculate the treated area with locally derived seeded soils.

Erosion control on the regraded sites would include actions to break up and prevent the formation of long flow paths. Regrading actions would leave some roughness in the soil and bio-logs or similar treatments would be installed at contour to detain concentrated flow. Natural revegetation of the site would be augmented with shrubs recovered from the removal areas. The area would be monitored for growth of invasive non-native plant species. Such species would be targeted for removal.

Alternative C would also include regrading activities at the pond enhancement site as described in Alternative B.

Cumulative Impacts
Under Alternative C, short-term impacts to previously disturbed soils would occur within the project area. The pond enhancement site is identified as an isolated wetland resource and is not evaluated as part of the cumulative impacts analysis. Because the natural soil horizon in the project area has already been highly altered, the activities associated with this project would not contribute to cumulative soil resource impacts within the Seashore.

Alternative C proposes activities that would result in changes to shoreline process and recontouring of areas previously disturbed in a manner that restores natural topography and vegetation patterns to the landscape. The other projects included in cumulative impact analysis will include activities of similar scale and scope. The actions are all conducted within previously disturbed areas, and are expected to result in long-term beneficial impacts to the evaluation area. The potential short-term impacts associated with Alternative C are related to soil disturbance are likely to persist for just one to two years. Installation of erosion fabric and coir-fiber logs to control erosion from the construction areas would reduce mobilization and erosion of sediment from the project area.

Conclusion
Under Alternative C, minor adverse short-term, impacts to soils and topography would result from removal of the spillway and dam sections, recontouring and revegetation of the quarry and access road areas, and regrading activities of the enhancement pond area. The actions proposed under Alternative C would result in long-term beneficial impacts to soils and topography within the project area and would not result in an impairment of park resources or values.

4.3.3.2 Water Resources and Shoreline Process

4.3.3.2.1 Shoreline Process/Marine and Estuarine Resources

Alternative C would result in the removal of 500 feet (approximately 5,000 cubic yards of fill) from the western side of the beach, as well as the cement spillway and associated fill. This would restore hydrologic circulation patterns to what they were prior to impoundment of the lagoon in the late 1940s (See Figures 2 & 3). In addition, restoring the outlet to the western side of the valley is consistent with the nearshore sand transport and lagoon outlet patterns through the rest of Drakes Bay. The water body would function as a lagoon, controlled by the beach barrier bar under most conditions. Tidal flooding and breaching would likely occur during full moon, spring, and neap tide cycles. Alternative C would restore the dynamic hydrologic and tidal equilibrium necessary to improve the long-term ecological conditions at the site.

Treatment at the CRLF Enhancement Area and old quarry would not affect Marine and Estuarine Resources.

4.3.3.2.2. Aquatic Habitat

The fill removal activities associated with Alternative C would be conducted in order to shift the main outlet to the western side of the valley. On the western side of the dam, excavation would continue below grade to the contact with the sand layer below. This would be done to prevent the remaining fill from acting as an elevation control in the future. It is expected that in the first year, extensive adjustment to this area would occur naturally. Over time, the bottom of the Horseshoe lagoon would scour under storm or tide driven events. In the long term, this would increase water depth and storage capacity in the lagoon.

The cement dam and associated fill would be removed from the eastern portion of the dam as described in Alternative B. When the western side is opened, it is likely that the east side outlet would

accumulate sand and vegetation slowly returning to a low energy, backwater that likely existed in this area for more than 500 years.

The changes in depth and water capacity of the lagoon would result in a change in the wetted area of the lagoon. When fully dammed, the area had the maximum wetted surface area, but minimal edge habitat. With the breach of the dam in 2002, the wetted area has been reduced, exposing wide, open flats, with water level controlled primarily by the beach elevation. Native vegetation has moved in to these exposed flats and filled to the new base water level. Under Alternative C, water elevation would be controlled by natural tidal and beach process. Since the 2002 breach event, vegetation has filled in the former mud flats, and now reaches the current waters edge. Future adjustments in vegetation would likely occur within the first one to two years.

The potential of the area to scour during large winter flow events would result in increased water depth, capacity, and aquatic habitat under Alternative C. The degree and timing of scour would be subject to natural conditions and may take 1-5 years to establish.

The restoration activities proposed under Alternative C would return the lagoon system to a state of dynamic equilibrium between the coastal and freshwater processes in the watershed. The restoration actions proposed at the former waste lagoon (as described under Alternative B) would dramatically improve the extent and condition of aquatic habitat at this site.

4.3.3.2.3 Salinity Regime

Current monitoring has shown the water body to shift from nearly fresh (<1 ppt salinity) to highly saline (>20 ppt salinity) on a given high tide cycle. Very few species are adapted to survive the severe range in salinity that has been observed in Horseshoe Pond. The actions proposed under Alternative C would restore dynamic equilibrium resulting in greater mixing throughout the year, and therefore less dramatic shifts in salinity.

Under Alternative C, the salinity in Horseshoe lagoon would still be balanced by the interactions of freshwater run-off and ocean driven high tides and storm surges. Saltwater would flood into the lagoon and then get mixed throughout by wind driven circulation processes. In years with high rainfall, the freshwater inflow to the lagoon would keep salinity levels low through dilution.

4.3.3.2.4 Water Quality

Increased tidal circulation and flushing of Horseshoe Pond would help alleviate poor water quality conditions in the system. Restoring natural hydrologic configuration and circulation patterns would reduce algal and zooplankton blooms in the long term. Alternative C would restore natural circulation and mixing regimes allowing for establishment of a dynamic equilibrium that reduces dramatic shifts in salinity, dissolved oxygen, and other factors that continue to limit the function of the ecosystem.

Currently the pond does not support many fish species due to degraded water quality conditions. The restoration actions are intended to improve seasonal flushing dynamics and should result in more balanced conditions during the summer months when dramatic fluctuations in dissolved oxygen has occurred.

Treatment at the Enhancement Site would improve habitat conditions and water quality within the former waste lagoon. Currently the pond embankment is completely covered in non-native weed species, and provides no structure or habitat to the pond area. Proposed restoration would add cover and structure to the pond, which would improve water quality conditions to the system.

Cumulative Impacts

All of the projects evaluated with regard to cumulative effects will have some level of impact on water resources. With the exception of the project to Stabilize the Historic Marine Lifeboat Station, all of these projects are being conducted with the intent of protecting or enhancing water quality, and restoring natural hydrologic and/or shoreline process, consistent with NPS management policies. The effects to water

quality and hydrologic process at each site would be localized during construction and would stabilize in 1-2 years. Many of these activities are intended to restore natural hydrologic and shoreline process that would enhance long-term function and habitat throughout the area. In the short-term, negligible cumulative adverse effects to water resources would result. In the long-term, minor beneficial cumulative effects would result in the Drakes Estero and Drakes Bay system.

Conclusion
The actions proposed under Alternative C would meet all of the objectives described in the project Purpose and Need by restoring circulation patterns to what they were prior to impoundment of the lagoon. Changes would include increased tidal influence and circulation in the winter, and reduced fluctuations in salinity and dissolved oxygen levels in the summer. Shoreline process and watershed runoff would likely reach dynamic equilibrium in 1-5 years.

Restoration of hydrologic flow patterns and shoreline process would reduce erosion potential to cultural resource site CA-MRN-394/H and would accelerate the return of the system to a state of functional dynamic equilibrium. The actions proposed under Alternative C would result in short-term, minor adverse impacts to water quality and estuarine resources as the system adjusts and stabilizes under a new hydrologic regime. This would be balanced by long-term beneficial impacts as the system meets dynamic equilibrium in a time period far shorter than what is expected under either Alternatives A or B.

The enhancement activities proposed at the former D-Ranch waste lagoon, road cut and quarry would result in short-term minor impacts to those sites and minor long-term beneficial impacts and facilitation of a healthy aquatic ecosystem at this site. Alternative C would remove structures that impede natural process and restrict return to dynamic hydrologic equilibrium. Consistent with NPS Management Policies, restoration actions proposed under this alternative address wetland, water quality and estuarine/lagoon degradation, as well as restoration of natural shoreline and hydrologic process to the area. This alternative would not result in impairment of water resources.

Work conducted under this alternative would require Clean Water Act Section 401 certification from the Regional Water Quality Control Board for water quality related issues.

4.3.3.3 Cultural Resources
In addition to the spillway structure addressed in Alternative B, Alternative C would result in the removal of part of the earthen-fill dam structure, as well as restoration and contouring of the associated road and quarry facilities. None of these features is considered historic, nor integral to the historic landscape of the facility. In addition, the NPS has worked closely with the Anthropological Resources Center of Sonoma State University and the Federated Indians of Graton Rancheria to document the extent of site CA-MRN-394/H to insure that all activities avoid that particular area. The excavation plans proposed under Alternative C do avoid all areas of concern through this project.

Restoring the historic and natural hydrologic and shoreline process to the site will likely result in reduced erosion and potentially increased sand deposition in the vicinity of the site CA-MRN-394/H.

Actions associated with Alternative C would also avoid impacts to the segment of either the *Pomo* or the *Shasta* (Newland 2002) which has been documented and is located in the open beach area, east of the work zone.

Actions under Alternative C would avoid, therefore not affect archaeological resources with the D-Ranch facility.

Cumulative Impacts
The actions proposed under Alternative C would not result in direct impacts to known cultural resources within the project area. These actions, in combination with other projects would not result in cumulative impacts to cultural resources within Drakes Bay. Restoring the historic and natural hydrologic and

shoreline process to the site will indirectly benefit the site as a result of reduced erosion and potentially increased sand deposition in the vicinity of CA-MRN-394/H.

Conclusion

The actions proposed under Alternative C would avoid areas identified as culturally significant, and therefore would not result in direct impacts to cultural resources within the project area. The restoration of historic configuration to the western side of the valley would provide for natural shoreline process. There is clear evidence that the western outlet was the primary outlet for more than 500 years, and it is likely that coastal circulation patterns would maintain this condition naturally. The restoration actions described under Alternative C would avoid direct impacts and would result in long-term beneficial impacts to the known cultural resources or an impairment of cultural resources or values.

No cultural resources are identified at the Enhancement Site, road cut or quarry sites. Treatment would not affect known cultural resources in this area.

4.3.3.4 Vegetation

In addition to actions at the spillway and CRLF pond enhancement sites described in Alternative B, restoration of the historic western channel would affect coastal brackish marsh, coastal salt marsh, and coastal prairie habitats. Removing the earthen material that blocks the historic channel would remove plant species associated with coastal prairie habitat, including *Baccharis pilularis* (coyote brush), *Rubus ursinus* (California blackberry), and mixed native perennial and non-native annual grasses. Recreating the historic channel from the pond to the beach would require clearing wetland vegetation associated with coastal brackish marsh habitat on the pond side of the berm and coastal salt marsh on the oceanside of the berm. Dominant species that would be removed from an approximate 0.6-acres include *Juncus lesueurii* (rush), *Scirpus pungens* (rush), and *Eleocharis macrostachya* (spikerush). With successful restoration of the outflow channel, it is not expected that these areas would be vegetated, with hydrologic processes maintaining an open, sandy bottom channel.

Vegetation in the disturbed areas of the quarry and road cut would be enhanced through restoration activities under Alternative C. Restoration of these sites would involve adding fill taken from the earthen berm along Horseshoe Pond, stabilizing soils through compaction, and installation of coir fiber logs (biologs) or coir fiber fabric to control erosion. Natural revegetation of the site would be augmented with shrubs recovered from the removal areas and active sowing of native grasses collected in the area during the spring and summer of 2004. Vegetative cover is expected to increase from <15 percent cover to 100 percent cover, taking on the characteristics of the surrounding coastal prairie habitat.

Vehicle traffic would also impact plants along the access road down to the historic channel and spillway site. Machinery would pass through coastal prairie habitat, coastal scrub, and some patches of coastal dune habitat along the berm flanking the southern shore of Horseshoe Pond. The majority of the old ranch road leading down to Horseshoe Pond is in coastal prairie habitat, but is dominated by non-native grasses and forbs. Coastal scrub habitat has closed in on the road between the quarry and the pond. *Baccharis pilularis* (coyote brush) and *Rubus ursinus* (California blackberry) would need to be pulled back to allow for the passage of vehicles. Coastal dune habitat occurs along the final part of the access road where wind has swept sand up onto the earthen berm.

Development of the CRLF Enhancement Site would include removal of non-native weed species and planting of willow, typha, bulrush and other native riparian vegetation.

Measures to reduce import of non-native seed to sensitive areas would include the use of clean equipment when the contractors arrive at the site, as well as construction progression. All work on the pond, quarry, and roadcut would be completed before initiating work on the enhancement site. Because the enhancement site is so overgrown with non-native forbs and grasses, this site would be treated last to prevent excessive tracking of equipment carrying seed to the areas nearer the lagoon site.

Cumulative Impacts

The actions proposed under Alternative C that would impact vegetation would be limited to less than three acres of the project area. In most cases vegetation would be mowed and, only in the excavation, regrading, and recontouring areas, would vegetation be removed. Treatment at the Horseshoe Pond sites would include erosion control, topsoiling, and erosion control to protect the soil resources. In most cases, primarily non-native forbs and grasses would be disturbed. The actions are proposed for already disturbed areas that are in an isolated area of the park and very limited in extent. The impacts to vegetation would be temporary. The actions under Alternative C, in conjunction with other restoration projects in the area, would not result in cumulative impacts to vegetation resources within Drakes Bay.

Conclusion
The actions proposed under Alternative C would have negligible, short-term and beneficial long-term impacts on vegetation within the project area. Because of the small area of impact and plans for replanting vegetation in the restored areas, Alternative C would not result in impairment of park resources or values related to vegetation.

4.3.3.5 Wetlands

Under Alternative C, wetlands at the spillway facility, historic channel, and the Enhancement Site would be impacted by restoration activities. No fill would be added to any of the areas identified as wetlands. Surveys of the quarry and roadcut areas were conducted, confirming no jurisdictional wetlands within the access roads and restoration area.

The description of impacts associated with spillway removal and the CRLF enhancement site are described in detail under Alternative B, Section 4.3.2.5.

Corps Wetlands
In addition to actions described under Alternative B, actions identified under Alternative C would result in the excavation of approximately 5,000 cubic yards of fill from the western side of the dam. The fill from the western side of the dam would be removed and replaced at the associated dam borrow area and also used to outslope and recontour the old road leading down to the dam facility. The excavation at the western dam site would result in the expansion of tidal wetlands and/or waters by approximately 0.4 acres within the project area.

Cowardin Wetlands
In addition to actions described under Alternative B, actions identified under Alternative C would result in the excavation of more than 5,000 cubic yards of fill from the western side of the dam (Figures 20 & 21).

Mechanized equipment would impact a total area of approximately 2.25-acres in order to restore the historic channel, quarry and roadcut. This would include excavation from the dam site and fill into non-jurisdictional upland areas including the quarry and roadcut for the dam. Fill would not be placed within any of the wetland areas associated with restoration of the historic channel. Within the impacted area is approximately 0.01-acres of wetland type E1UBLh (Estuarine Subtidal, Unconsolidated Bottom, Subtidal, diked/impounded), 0.02-acres of wetland type E2EMPh (Estuarine Intertidal, Emergent, Irregularly Flooded, diked/impounded), 0.25-acres of wetland type M2USP (Marine Intertidal, Unconsolidated Shore, Irregularly Flooded), and 0.32-acres of wetland type PEMCh (Palustrine Emergent, Seasonally Flooded, diked/impounded). Expanded descriptions of these wetland types at the Enhancement Site may be found in the Horseshoe Pond Wetland Delineation Report. Restoration of the historic channel outflow is expected to convert PEMCh wetlands to E2EMP wetlands and E2SBP wetlands. E2SBP wetlands would characterize the estuarine intertidal channel to be developed. E2EMP wetlands would characterize estuarine intertidal wetlands that would develop along the channel border following establishment of marine influence.

In addition, implementation at the 2.05-acre CRLF enhancement site would be expected to permanently convert PUBChx and PUBFhx wetland types to PUBHhx wetlands for a total of approximately 0.66-acres of PUBHhx wetlands available as CRLF habitat (Figure 19). Implementation at the 0.27-acre spillway site would result in expansion of E2EMP wetlands and E2SBP wetlands by 0.12 acres (fill removal area) (Figure 18).

Cumulative Impacts

The actions proposed under Alternative C would result in the restoration of < 1acre of jurisdictional tidal waters and wetlands, as well as isolated waters and wetlands, and Cowardin intertidal emergent and palustrine emergent wetlands to the area. The work in the spillway area would be limited, and work in the enhancement area is on isolated wetland resources. The most substantial change would be associated with the restoration of the western outlet to the lagoon. This would result in conversion of a small, freshwater wetland on the beach side, to an expanded tidal wetland and waters resource. Actions associated with other projects proposed within the Drakes Bay watershed are intended to restore natural tidal process to an additional five acres of habitat. Cumulatively projects would result in creation of only a small area of wetlands, currently filled by dams or berms.

Alternative C would result in a net gain of wetlands to the Drakes Bay area, and wetland impacts associated with the project are anticipated to be temporary. Actions under Alternative C would not result in cumulative impacts to wetland resources within Drakes Bay.

Conclusion

The actions proposed under Alternative C would result in minor short-term adverse impacts, but beneficial long-term impact to wetland habitat within the project area. The net expansion of wetlands by up to one acre through the removal of fill at the spillway and western dam facility, and recontouring and enhancement of the CRLF site would result in long-term beneficial impacts to the project area. The actions proposed under Alternative C would result in the net expansion of wetlands. Changes in water regime and source of water (from freshwater to saline water) would result in the conversion of some wetland types within the project area. In the interim, the wetland resources would adjust and change, primarily with the changes in tidal circulation and shoreline process. Alternative C would not result in impairment of park resources or values related to wetlands. Work conducted under this alternative would require permits from the US Army Corps (Clean Water Act Section 404) and a coastal consistency determination/Coastal Permit from the California Coastal Commission for work in the wetland resource areas. An NPS Wetland Statement of Findings is not required in cases when there is no long-term loss of wetland area. The park seek concurrence with the NPS Water Resources Division in conjunction with USACE and California Coastal Commission wetland permits.

4.3.3.6 Special Status Species

4.3.3.6.1 Amphibians

Alternative C would change the outlet location, shoreline process, and hydrologic circulation patterns in the project area. Water level at has been effectively controlled by the beach bar elevation since January 2002. The beach sand would remain the elevation control for the lagoon system. The conditions effecting the persistence and productivity of California red-legged frogs (CRLF) at Horseshoe Pond is likely the hydrologic regime, and its effect on salinity and water storage duration. Potential flushing and scour through the new outlet could increase the water capacity of the site from current conditions.

Following restoration activities under Alternative C, salinity levels and CRLF breeding success would continue to be controlled by shoreline process, storm timing, and watershed runoff. These parameters would vary interannually. In years with high rainfall, the freshwater outflow from Horseshoe Pond would increase dilution, keeping salinity levels low and the potential for successful CRLF breeding high, as was the case in the winter of 2002. In years when freshwater run-off is not enough to counterbalance tidal intrusion into Horseshoe Pond, salinity levels would increase and perhaps temporarily lessen CRLF breeding success.

While restoration activities conducted under Alternative C would shift the outlet to the west side and result in more dynamic hydrologic and shoreline process, it is not expected to shift the overall hydrologic and salinity regimes far beyond the current patterns. It is likely that habitat patterns would adjust with the restoration of natural shoreline and hydrologic processes. As noted, however, the

drivers of the system, rainfall-runoff patterns and shoreline process would continue to control the system. CRLF breeding potential would continue to be enhanced during years with high rainfall and reduced during dry years. The activities proposed under Alternative C are not likely to create permanently unsuitable breeding habitat for CRLFs in Horseshoe Pond.

Alternative C would also include restoration of habitat for the CRLF at the Enhancement Site. This pond covers more than one acre. As it was constructed for waste storage, the banks are very steep and covered by non-native weeds. Regrading of these banks would enhance the pond edge habitat, creating areas where emergent vegetation may establish, as well as more hospitable upland non-breeding habitat and refugia.

Cumulative Impacts

Some of the proposed marsh restoration activities associated with Horseshoe Pond, Glenbrook Dam, and the Coastal Restoration Project (this includes nine treatment sites) would result in the conversion of freshwater or low salinity aquatic environments to estuarine aquatic habitat. Based on site surveys, only two sites (Horseshoe and Limantour Beach Pond) are known to support the California red-legged frog. As noted in the determination of impairment section for this species, more than 120 sites have been documented to support California red-legged frog breeding. This project would result in enhancement of one site in the area, and would not actually change conditions in a manner to preclude the ongoing use of the Horseshoe Lagoon as breeding habitat (as it has been used the past two years). In addition to the known sites, the USGS-BRD is currently surveying Wilderness sites within the Seashore, potentially documenting more breeding habitat locations. The result of these surveys will be the development a prioritized list and plan to maintain the highest quality Wilderness CRLF breeding habitat.

The actions proposed under Alternative C, in combination with other restoration projects in the Drakes Bay Area, would not jeopardize the persistence of California red-legged frogs in the area.

Conclusion

Alternative C would not dramatically change hydrologic conditions or effects to the CRLF beyond those described under Alternative A or B. Because conditions may change to some degree, but the area would still likely support breeding habitat for the frogs, it is determined that Alternative C would result in minor, long-term, adverse impacts to the California red-legged frog and associated breeding habitat at Horseshoe Pond. Alternative C does provide additional enhancement habitat for the CRLF through the restoration of a former waste lagoon near the D-Ranch Complex. This would add another breeding habitat, including more than one acre of aquatic habitat that may be used by the CRLF, adjacent to the existing habitat. Improvements proposed for the Enhancement Site would result in minor, beneficial long-term impacts to special status amphibians.

Horseshoe Pond represents one of more than 120 known breeding areas in the park, and the pond would continue to provide the existing quality of breeding and foraging area. In addition, Alternative C includes the enhancement of a former waste lagoon to support critical habitat for the CRLF. Alternative C would not result in impairment of park resources or values associated with species listed under the Endangered Species Act.

4.3.3.6.2 Plants

Access to the concrete channel would pass along the earthen berm in extremely close proximity to the pink sand verbena (*Abronia umbellata* ssp. *breviflora*), San Francisco Bay spineflower *(Chorizanthe cuspidata* var. *cuspidata, FSC*), and wooly headed spineflower (Chorizanthe cuspidata var. villosa, FSC) populations. These areas would be marked in the field and would be avoided during construction. Temporary fencing material would be used to delineate the boundary of the population and ensure that machinery traffic will not jeopardize the persistence of pink sand verbena at the site.

Actions conducted to restore the outlet to the west side of the valley as part of Alternative C would result in some disturbance of areas adjacent to where pink sand verbena is known to occur. Because pink sand verbena seeds out between August and October, it would not be possible to avoid the

seeding window for the plants. However, prior to construction activities, the site would be surveyed for the plant. Areas where the plant is located would be flagged and avoided during construction. As part of the outlet activities, vegetation and some fill would be removed south of the dam to encourage flow to the area. Because the pink sand verbena occurs on the sandy areas of the beach, these areas may be avoided by construction activities. In areas where the plant is known to occur, but is not present, the surface sand layer would be stockpiled and spread to nearby areas following construction, allowing for natural regeneration of pink sand verbena from seed the following season.

The two marsh milkvetch plants (*Astragalus pycnostachyus* var. *pycnostachyus*) located near the concrete spillway are located outside of the disturbance footprint of this area and would not be impacted by restoration activities.

There are no special status plant species located at the quarry, road cut or CRLF enhancement sites of this project.

Cumulative Impacts

Surveys conducted on sites associated with the projects evaluated for cumulative impacts do not contain either the pink sand verbena, San Francisco Bay spineflower, wooly headed spineflower, or the marsh milkvetch. Potential indirect or direct impacts to these species associated with Alternative C would not result in cumulative impacts beyond those in this specific project.

Conclusion

The activities conducted under Alternative C would avoid direct impacts to known special status plant species within the area. Park staff would fence out areas supporting these species to avoid disturbance. It is possible that through restoration of the historic outlet and shoreline process, the area supporting pink sand verbena may actually expand. Soil adjacent to growing areas which could contain seed would be stockpiled and reapplied to the area at the end of the restoration activities. Alternative C could result in minor, long-term beneficial impacts effects to special status plant species and would not result in an impairment of park resources associated with special status plant species.

4.3.3.6.3. Other Special Status Species

Impacts to other special status species would be similar to the effect described in Alternative A. Restoration of natural hydrologic, shoreline process, and water quality conditions will support a greater diversity of species within the waterbody. The CRLF Enhancement Project could have a long-term, negligible, beneficial impacts on western pond turtle by providing additional breeding habitat following restoration of the waste lagoon.

The project area has been identified as a potential site for the experimental reintroduction of the tidewater goby as part of the recovery planning effort (Jacobs 2004 personal communication). Changes in the system, including restoration of this historic western outlet would likely introduce the potential for scour and deepening of the system, as well as allow for the dispersal of stored nutrients driving summer water quality variability. The hydrologic regime under Alternative C would reintroduce natural hydrologic and shoreline dynamics and likely a more sustainable ecological regime. These conditions would be compatible with potential goals associated with the tidewater goby recovery, and could make the Horseshoe Pond a viable reintroduction location for an experimental tidewater goby population.

Cumulative Impacts

Activities conducted under Alternative C and the projects considered for potential cumulative impacts may result in reduced habitat availability. The Horseshoe Pond project includes enhancement of one pond facility which would support the western pond turtle, and offset cumulative watershed changes, resulting in negligible beneficial impacts to the western pond turtle and bird species that would use from the enhanced pond habitat. Very few sites on the open coast have been identified as likely to support the tidewater goby. Activities conducted under Alternative C could be beneficial to tidewater goby habitat within the cumulative planning area.

Conclusion

Restoration of natural shoreline and hydrologic process would have benefits to water quality and food supply that could benefit multiple bird species known to use the project area. Actions under Alternative C could facilitate development of habitat that could support an experimental tidewater goby reintroduction. Alternative C would result in beneficial long-term impacts on special status species within the project area and would not impair park resources associated with special status species.

5.0 CUMULATIVE IMPACTS

The Council on Environmental Quality (CEQ) NEPA regulations 1508.7 states, 'Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

5.1 CURRENT AND ONGOING ACTIONS

Cumulative impacts are described at the watershed (Horseshoe Pond), and coastal area (Drakes Bay and Estero).

Within the watershed, the dairy associated operations have been removed since 1998, and the upland pastures are accessible for managed grazing. No other activities are planned to occur within the watershed. The managed grazing activities will limit cattle and require that adequate vegetation cover is left to protect the slopes from runoff.

Along the coast, the restoration actions proposed for Horseshoe Pond are similar to those proposed for the Glenbrook Quarry Restoration (summer 2005). In addition, other restoration activities associated with the Coastal Watershed Restoration Project, including dam removal and tidal marsh restoration, will occur in summer 2006. All of these projects are intended to restore natural hydrologic and ecological process to the area. Other activities within the Drakes Estero and Drakes Bay watershed include replacement of the waste transfer system at the Ken Patrick Visitors Center (2003-2004), and Stabilization of the Historic Lifeboat Station Marine Railway (2005 or 2006). Both of these projects are categorically excluded and will not result in impacts that influence the proposed restoration project.

5.2 PAST RESTORATION AND MONITORING ACTIVITIES

The extent of past activities in the watershed is limited to the emergency stabilization and cleanup of the D-Ranch buildings following closure of the dairy and historic agricultural operations. The NPS initiated extensive monitoring of the Horseshoe Pond site in 2001 to document resources described in this document. All monitoring in the watershed has been conducted in association with the planning for this project.

Since the closure of the D-Ranch dairy operation, there are now three dairies within the Drakes Bay watershed. The NPS has conducted water quality monitoring activities in streams draining to Drakes Bay for the past five years and has documented high levels of pathogens and nutrients discharging to the Bay. In 2003, the NPS, in cooperation with Marin County, sampled Drakes Beach weekly between April and October for recreational water quality. The beach met contact recreational water quality levels through the entire summer. No other water quality monitoring of coastal water resources is conducted in Drakes Bay.

Detailed water quality monitoring of the Horseshoe Pond area itself has been ongoing since 2000 and is summarized as part of the affected environment and water resources impact topics within the document. In general, water quality within the pond is seasonally degraded, with large-scale algal and zooplankton blooms in the summer, as well as high variability in dissolved oxygen and observed fish kill events. In the winter and spring, the water body supports breeding habitat for the California red-legged frog. Many of the conditions observed in the waterbody are aggravated due to constrained hydrologic circulation, and the accumulation of nutrient rich runoff during the lifetime of the pond.

The NPS plans implementation of a monitoring program that will document condition and performance of the restoration over time. Methods used will be adapted from more detailed long-term monitoring plans being developed for the Giacomini Wetland Restoration. At minimum photo monitoring and water quality monitoring will be conducted. In addition, vegetation surveys will be conducted to control non-native species and document the recurrence of special status plant species. The USGS-BRD conducts limited surveys at this site annually, and will continue to do so. The unusual conditions currently present, and understanding of the progress of the species is important for long-term management at the Seashore.

5.3 CUMULATIVE IMPACTS

This cumulative impacts section analyzes the potentially compounded impacts of implementation at all project sites. Because each of these projects (see Section 1.4.1) is identified, individually, as a restoration of natural ecological and physical process, this section is important to ensure that cumulatively, the ecological resources can adjust to the changes in process brought about by these federal actions. For the most part This section summarizes the cumulative impacts by alternative.

5.3.1 Alternative A

Under Alternative A, no direct action would occur as a result of the project. Under Alternative A, the Horseshoe Pond project would not contribute to cumulative impacts associated with direct actions within the project area. In the long-term, continued degraded water quality conditions and constraints on natural shoreline and hydrologic process would continue in the Drakes Bay area.

5.3.2 Alternative B

Under Alternative B, the removal of the cement dam and associated fill would be negligible at both the watershed and Drakes Bay scale. This action in the pond area would not actually change physical or ecological conditions beyond their current state. The activities proposed for the former waste lagoon would result in enhancement of habitat to support the California red-legged frog. Because the pond is considered isolated by the US Army Corps, the work at that site would not result in cumulative impacts to water resources. Overall, the cumulative impacts of Alternative B would be negligible and adverse in the short term, and negligible beneficial in the long-term.

5.3.3 Alternative C

Under Alternative C, treatment actions will result in the excavation of fill and restoration of the lagoon outlet to the west side of the waterbody. The short-term impacts associated with construction are minor, as the project will occur in an area where dynamic processes are desireable. Effects on most resources will be limited to the construction period. Descriptions of the impact topics subject to the greatest change (Water Resources and Special Status Species) in association with the proposed actions are included below.

Water Resources and Shoreline Process

All of these projects within the cumulative impact analysis intend to restore natural hydrologic or physical process which would have some level of impact on water resources. Nearly all of these projects are being conducted with the intent of protecting or enhancing water quality, and the restoring natural hydrologic and/or shoreline process, consistent with NPS management policies. The effects to water quality and hydrologic process at each site would be localized during construction and would stabilize in 1-2 years. The restoration of natural hydrologic and shoreline process would enhance long-term function and habitat throughout the area. In the short-term, negligible cumulative adverse effects to water resources would result. In the long-term, minor cumulative benefits to the Drakes Estero and Drakes Bay system would occur in association with Alternative C.

Special Status Amphibians – California red-legged frog

Some of the proposed marsh restoration activities associated with Horseshoe Pond, Giacomini Wetland, and the Coastal Restoration Project would result in the conversion of freshwater or low salinity aquatic environments to estuarine aquatic habitat. Based on field surveys projects at Horseshoe, Limantour Beach Pond, and Giacomini would result in impacts to pond habitat that are known to support the California red-legged frog. As noted in the determination of impairment section for this species, more than 120 sites within the park have been documented to support California red-legged frog breeding. The Horseshoe Pond project would result in enhancement of one adjacent site (former waste lagoon), and is not likely to change conditions in a manner to preclude the ongoing use of the Horseshoe Lagoon as breeding habitat (see water resources impact analysis). The current water regime, controlled by beach process and freshwater runoff has supported conditions that have resulted in CRLF breeding activities since the breach in January 2002. Cumulatively, planned projects within the park will potentially result in changes or conversion of habitat at three documented breeding habitat sites. The proposed enhancement associated

with the Horseshoe Pond restoration is intended to offset the potential changes that may occur within Horseshoe Pond.

In addition to the known sites, the USGS-BRD is currently surveying Wilderness sites within the Seashore, potentially documenting more breeding habitat locations. The result of these surveys will be the development a prioritized list and plan to maintain the highest quality Wilderness CRLF breeding habitat.

The cumulative impacts of activities occurring within the Drakes Bay area would result in minor adverse impacts to the California red-legged frog. This project would not jeopardize the persistence of California red-legged frogs in the project area or within the park.

Conclusion

Overall cumulative analysis for Alternative C indicates that it would result in short-term adverse minor impacts. The restoration of natural shoreline and hydrologic process would result in long-term minor beneficial impacts to the Drakes Bay area.

5.4 SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

The preferred alternative would restore natural hydrologic and shoreline process, consistent with NPS management policies (NPS 2000). The historic shoreline process supported a viable lagoon system that functioned within a healthy dynamic equilibrium. The current constraints have resulted in degraded water quality and an inability of the system to adjust to conditions, limiting the ecological condition and productivity of the system.

The local short-term uses of the environment following implementation of the preferred alternative would include lagoonal and freshwater habitat restoration. The resulting long-term productivity would include sustainable hydrologic, coastal, and ecological process, enhancement of rare lagoonal habitat in the area, and improved water quality conditions at this site.

6.0 CONSULTATION AND COORDINATION

6.1 AGENCIES AND ORGANIZATIONS

Federated Indians of Graton Rancheria. An archeological site documented in 1960 was rediscovered during project planning for Horseshoe Pond restoration. The location of the archeological site was considered in redesigning the proposed action and limits of site disturbance during implementation. The cultural resources study was undertaken in consultation with the Federated Indians of Graton Rancheria (FIGR), the recognized affiliated tribe for lands in Point Reyes National Seashore, and tribal members helped to define restoration boundaries. A FIGR representative was involved with initial site surveys. The NPS will continue to coordinate with the FIGR to insure that either an NPS or FIGR representative is on site during the construction activities.

US Fish and Wildlife Service & National Marine Fisheries Service. ***Endangered Species Act of 1973, as amended, PL 93-205, 87 Stat. 884, 16 USC §1531 et seq.*** These two agencies are responsible for administering the Endangered Species Act of 1973 which protects threatened and endangered species from unauthorized "take", and directs federal agencies to ensure that their actions do not jeopardize the continued existence of listed species. Section 7 of the act defines federal agency responsibilities for consultation with the U.S. Fish and Wildlife Service, or the National Marine Fisheries Service (the latter is responsible for fish and marine mammal species). Consultation requires preparation of a Biological Assessment to identify any threatened or endangered species that is likely to be affected by the proposed action. The NPS has initiated informal consultation with the U.S. Fish and Wildlife Service and NOAA Fisheries regarding this project.

State Historic Preservation Officer. The National Historic Preservation Act of 1966 requires agencies to take into account the effects of their actions on properties listed in or eligible for listing in the National Register of Historic Places. The Advisory Council on Historic Preservation has developed implementing regulations (36 CFR 800), which allow agencies to develop agreements for consideration of these historic properties. The NPS, in consultation with the Advisory Council, the California State Historic Preservation Officer (SHPO), American Indian tribes and the public, has developed a Programmatic Agreement for operations and maintenance activities on historic structures. This 1995 Programmatic Agreement (available on the web at http://www.achp.gov/npspa1.html) provides a process for compliance with National Historic Preservation Act, and includes stipulations for identification, evaluation, treatment, and mitigation of adverse effects for actions affecting historic properties.

Regional Water Quality Control Board. The San Francisco Bay Regional Water Quality Control Board is responsible for Clean Water Act 401 certification on projects that may effect water resources. An onsite visit was conducted with staff from the Board. Application for CWA 401 certification will be submitted to the San Francisco Regional Water Quality Control Board in conjunction with to the public release of the Environmental Assessment.

U.S. Army Corps of Engineers. The Clean Water Act provides for the restoration and maintenance of the physical, chemical, and biological integrity of the nation's waters. Section 404 of the act prohibits the discharge of fill material into navigable water of the United States, including wetlands, except as permitted under separate regulations by the U.S. Army Corps of Engineers and U.S. Environmental Protection Agency. The project will be conducted within jurisdictional wetlands as confirmed by the US Army Corps of Engineers August 13, 2002. The project will require 404 permits through the Corps. Application for these permits under Nationwide Permit 27 will be submitted in conjunction with public release Environmental Assessment.

California Coastal Commission (CCC). The project is within the coastal zone, and subject to federal consistency review by the CCC to ensure the project is consistent with state coastal zone management guidelines. Review of the project will be initiated in conjunction with public release Environmental Assessment.

6.2 ANTICIPATED PERMITS

This project will require consultation and permits through the following agencies:

California Coastal Commission – Federal consistency review and coastal permit
San Francisco Regional Water Quality Control Board – Clean Water Act Section 401 certification
US Army Corps of Engineers – Clean Water Act Section 404 consultation and permit
US Army Corps of Engineers – Rivers and Harbors Act Section 10 review
US Fish and Wildlife Service – Endangered Species Act – Section 7 consultation
National Marine Fisheries Service - Endangered Species Act – Section 7 consultation
California Historic Preservation Office – Section 106 documentation and compliance
Federated Indians of Graton Rancheria – Section 106 consultation

6.3 PERSONS CONSULTED

Rich Stallcup, Ornithologist
Marla Lafer - San Francisco Bay Regional Water Quality Control Board
Leslie Ferguson – San Francisco Bay Regional Water Quality Control Board
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6.5 PUBLIC AND AGENCY SCOPING AND SUMMARY OF ISSUES RAISED

Project scoping was conducted between July 19, 2002 and August 19, 2002. The scoping document was sent to the park friends mailing list including more than 200 addresses of agencies and interested parties. A total of 3 comments were submitted to the NPS regarding this proposed project. Issues raised in these responses are listed below and have been addressed within this Environmental Analysis.

Special Status Species – Plants
Concern over potential impacts to *Abronia umbellata ssp. breviflora*, a plant listed in the California Native Plant Society's Inventory of Rare and Endangered Plants as Category 1B meaning "rare, threatened or endangered in California and elsewhere (CNPS, 2004). The comment related that because low numbers of plants exist in the Seashore, the population in this area is at risk.

Wildlife - Birds
Comments by the public emphasized the location of the area facilitates use by various avian species and that, "restored, Horseshoe Pond could be a significant avian habitat." This supports the proposed project to restore natural process to the area.

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GLOSSARY

acre-foot - One acre-foot is the volume of water sufficient to cover an acre of land to a depth of 1 foot, = 43,560 cubic feet, approximately 325,851 U.S. gallons
cyanobacteria - predominantly photosynthetic prokaryotic organisms containing a blue pigment in addition to chlorophyll; occur singly or in colonies in diverse habitats; important as phytoplankton
dinoflagellate - chiefly marine protozoa having two flagella; a chief constituent of plankton
diurnal - recurring every day or having a daily cycle
emergent vegetation - A rooted plant that has parts extending above the water surface for at least part of the year, and is intolerant of complete inundation over prolonged periods.
eutrophic - Having waters rich in mineral and organic nutrients that promote a proliferation of plant life, especially algae, which reduces the dissolved oxygen content and often causes the extinction of other organisms. Used of a lake or pond.
isocline - an abrupt separation in salinity within a water body.
oligohaline - Containing waters which just meet the definition of brackish or saline. The level of salinity in oligohaline waters is just above the range of salinity found in fresh water (0.5-5 ppt).
overwash –the deposit left after such a high water pulse overtops or breaches the dune line of a barrier beach
palustrine -- All non-tidal wetlands that are substantially covered with emergent vegetation--trees, shrubs, moss, etc. Most bogs, swamps, floodplains and marshes fall in this system, which also includes small bodies of open water
phytoplankton- A type of plant plankton, such as algae, that is the basic food source in many aquatic and marine ecosystems.
rotifer - minute aquatic multicellular organisms having a ciliated wheel-like organ for feeding and locomotion; constituents of freshwater plankton
thermocline – an abrupt separation in temperature within a water body.
zooplankton - animal constituent of plankton; mainly small crustaceans and fish larvae

APPENDICES

APPENDIX A – SPECIAL STATUS SPECIES TABLE

List of special status plant and animal species with potential to occur in the Horseshoe Project Restoration Project Area and vicinity. Potential to occur based on known species ranges, general habitat requirements, and historical sightings.					
SCIENTIFIC NAME	**COMMON NAME**	**STATUS**	**HABITAT**	**COMMENTS**	**OCCURS IN PROJECT AREA?**
MAMMALS					
Lutra canadensis sonorae	Southwestern river otter	FSC	Estuaries, rivers, marshes, and riparian.	Pups seen in 2001 in Papermill Creek, Lagunitas Creek, and Walker Creek (S. Allen, 2001).	No
Zapus trinotatus orarius	Point Reyes jumping mouse	FSC	Riparian and grassland.	Occurrence near Abotts Lagoon and Limantour Beach (G. Fellers, 2002)	Likely (see comment)
BIRDS					
Gavia immer	common loon	FSC	Lakes, ponds, and estuaries.	Regularly occurring in winter mostly (Stallcup 2000).	Likely (see comment)
Pelecanus occidentalis californicus	California brown pelican	FE	Open water and roosts on mud flats and offshore rocks; breed in Channel Islands.	Does not breed at PRNS, but commonly occur along coastline in summer mostly.	Yes
Botaurus lentiginosus	American bittern	FSC	Emergent vegetation of freshwater and brackish marshes.	Breeds at PRNS (Stallcup 2000).	Yes
Ixobrychus exilis	least bittern	FSC	Emergent vegetation in freshwater, occasionally coastal brackish marshes.	Rare, summer mostly (Stallcup 2000).	No
Egretta thula	snowy egret	FSC	Marshes, lakes, ponds, shallow coastal habitats.	Regularly occurring breeding resident (Stallcup 2000).	Yes
Elanus leucurus	white-tailed kite	FSC	Savanna, riparian woodland, marsh, partially cleared or cultivated fields, grassy foothills.	Regularly occurring resident at PRNS (Stallcup 2000).	Likely (see comment)
Buteo regalis	ferruginous hawk	FSC	Breeds in open country, including prairie grassland, shrub, and steppe using a tree where available. Also nests in low hillside bushes, a ledge of a rock outcrop or cliff, or among rocks on a hillside.	Not known to breed at PRNS; winters mostly, but occurs rarely (Stallcup 2000).	Likely(see comment)
Accipiter gentilis	northern goshawk	FSC	Mixed, mostly coniferous forest, open woodland.	Rare; winter mostly (Stallcup 2000).	No
Buteo swainsoni	Swainson's hawk	FSC	Savanna, prairie, desert, open pine-oak woodland, cultivated lands with scattered trees.	Rare migrant (Stallcup 2000).	No
Falco peregrinus anatum	American peregrine falcon	FD	High cliffs, ledges for nesting	May breed at PRNS; observed within Project Area in the summer and fall.	Yes

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SCIENTIFIC NAME	**COMMON NAME**	**STATUS**	**HABITAT**	**COMMENTS**	**OCCURS IN PROJECT AREA?**
Laterallus jamaicensis coturniculus	California black rail	FSC	Freshwater, saltwater or brackish marshes bordering large bays	Rare but regular breeding resident (Stallcup 2000). Observed at Kehoe Marsh and upper Olema Marsh (NDDB 2000).	No
Rallus longirostris obsoletus	California clapper rail	FE	Salt marsh, estuarine	Rare; winter mostly (Stallcup 2000).	No
Charadrius alexandrinus nivosus	western snowy plover	FT	Sandy beaches, salt pond levees; needs sandy, gravelly, or friable soil for nesting.	Nests on the Great Beach between North Beach and Kehoe and NW Limantour Beach (PRBO 2001).	Yes
Numenius americanus	long-billed curlew	FSC	Nests in prairies and grassy meadows, usually near meadows; forages on beaches and mudflats.	Regularly occurring resident (Stallcup 2000).	Yes
Athene cunicularia	burrowing owl	FSC	Nests in burrows in open fields; winters in same area.	Rare but regular migrant to PRNS (Stallcup 2000).	Likely (see comment)
Chaetura vauxi	Vaux's swift	FSC	Forests, especially with burned or cutover areas providing snags; nests on inside walls of hollow trees and occasionally in chimneys.	Regularly occurring migrant, not known to breed at PRNS (Stallcup 2000).	Likely (see comment)
Cypseloides niger	black swift	FSC	Breeds on cliffs adjacent or behind waterfalls in canyons and sea-bluffs above surf.	Not known to breed in PRNS but migrates through (Stallcup 2000).	No
Calypte costae	Costa's hummingbird	FSC	Desert, arid brushy foothills, chaparral.	Rare migrant (Stallcup 2000).	No
Selasphorus sasin	Allen's hummingbird	FSC	Chaparral, thickets, brushy slopes, open coniferous forest.	Regularly occurring breeder; summer mostly (Stallcup 2000).	Yes
Contopus cooperi	olive-sided flycatcher	FSC	Open montane and boreal coniferous forests and coniferous/deciduous forests, especially with abundant dead trees.	Regularly occurring breeder; summer mostly (Stallcup 2000).	Likely (see comment)
Empidonax wrightii	gray flycatcher	FSC	Sagebrush, arid open woodland.	Rare migrant (Stallcup 2000).	No
Empidonax difficilis	Pacific-slope flycatcher	FSC	Deciduous and coniferous forests and woodlands, especially near water.	Regularly occurring breeder; summer mostly (Stallcup 2000).	Likely (see comment)
Empidonax traillii brewsteri	little willow flycatcher	FSC	Riparian habitat	Rare but regular migrant through PRNS (Stallcup 2000).	No
Riparia riparia	bank swallow	FSC	Open country, savanna, especially near running water.	Rare but regular migrant (Stallcup 2000).	Yes

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Lanius ludovicianus	loggerhead shrike	FSC	Open fields with scattered trees, open woodland, scrub.	Regularly occurring in winter mostly; breeds at PRNS (Stallcup 2000).	Likely (see comment)
Dendroica occidentalis	hermit warbler	FSC	Mature coniferous forest.	Regularly occurring migrant with occasional breeding (Stallcup 2000).	Likely (see comment)
Geothlypis trichas sinuosa	saltmarsh common yellowthroat	FSC	Freshwater, saltwater marshes with thick, continuous cover	Breeds in coastal marshes throughout PRNS (NDDB 2000). Observed at top of west arm of Horseshoe Pond.	Yes
Ammodramus savannarum	grasshopper sparrow	FSC	Grassland, cultivated fields, prairie, old fields, open savanna.	Rare but regular breeder; summer mostly (Stallcup 2000). Vocalization heard within Project Area in Spring 2001.	Yes
Amphispiza belli belli	Bell's sage sparrow	FSC	Breeds in chaparral sagebrush and other low arid scrub.	Sage sparrow is a rare migrant at PRNS (Stallcup 2000).	No
Chondestes grammacus	lark sparrow	FSC	Grassland, prarie, savanna, cultivated areas, fields with scattered trees and shrubs.	Rare but regular migrant; limited breeding may occur (Stallcup 2000).	Likely (see comment)
Spizella atrogularis	black-chinned sparrow	FSC	Chaparral, sagebrush, arid scrub, and brushy slopes.	Rare; summer mostly (Stallcup 2000).	No
Agelaius tricolor	tricolored blackbird	FSC	Open country, protected nesting substrate.	Observed east side of Tomales Point, Cypress Grove Preserve (NDDB 2000); known to winter at the D Ranch most recently (D. Adams, 2001).	Yes
REPTILES					
Clemmys marmorata mormorata	northwestern pond turtle	FSC	Near-permanent water with basking sites	First documented in Horseshoe Pond in October 2001.	Yes
AMPHIBIANS					
Rana aurora draytonii	California red-legged frog	FT	Deep pools with dense, shrubby, or emergent vegetation	Present in numerous areas in PRNS. Area has been declared critical habitat by USFWS. First observed in Project Area in 1995.	Yes
FISH					
Eucyclogobius newberryi	tidewater goby	FE	Brackish water in shallow lagoons and lower stream reaches	Potentially occurred but never documented in Horseshoe Lagoon or Drakes Estero system (Jacobs personal communication 2004). Site identified as potential experimental reintroduction site for tidewater goby.	No

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Oncorhynchus kisutch	coho salmon – central CA coast	FT	Needs beds of loose, silt-free coarse gravel for spawning; needs cover, cool water and sufficient dissolved oxygen.	Spawn in Olema Creek, Lagunitas Creek, Devil's Gulch, and San Geronimo Creek (NDDB, 2000).	No
Oncorhynchus mykiss	central CA coastal steelhead	FT	Needs beds of loose, silt-free coarse gravel for spawning; needs cover, cool water and sufficient dissolved oxygen.	Spawn in most coastal drainages in PRNS, including several streams in the Drakes Estero watershed.	No
INVERTEBRATES					
Cicindela hirticollis gravida	sandy beach tiger beetle	FSC	Coastal sand dunes.	Distribution and abundance unknown (D. Adams, 2001)	Unknown
Coelus globosus	globose dune beetle	FSC	California coastal dunes; subterranean dweller.	Distribution and abundance unknown (D. Adams, 2001)	Unknown
Icaricia icarioides	Point Reyes blue butterfly	FSC	Lupine is host plant.	Distribution and abundance unknown, but 1992 surveys located this butterfly at Tomales Point and North Beach dunes (D. Adams, 2001).	Unknown
Ischnura gemina	San Francisco forktail damselfly	FSC	Wetlands.	Observed and collected at PRNS.	Unknown
Lichnanthe ursina	bumblebee scarab beetle	FSC	Coastal sand dunes.	Ranges from Sonoma to San Mateo Counties. Observed at MCI/RCA site 6/00 and 7/01; distribution and abundance at PRNS unknown (D. Adams, 2001).	Unknown
Speyeria zerene myrtleae	Myrtle's silverspot butterfly	FE	Dune and coastal grassland. *Viola adunca* is host plant.	Host plant and individual butterflies observed within Horseshoe Pond watershed, but not Project Area.	Likely (see comment)
Syncaris pacifica	California freshwater shrimp	FE	Lowland coastal perennial streams	Found primarily in Sonoma, Marin, and Napa counties. Reported upstream in Lagunitas Creek; observed in lower Olema Creek, Walker Creek and tributary to Keys Creek (NDDB 2000, Fong and Lo Bianco 2003).	No

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PLANTS					
Abronia umbellata ssp. *brevifolia*	pink sand-verbena	FSC	Disturbed sandy areas; coastal dunes and scrub; <100 m.	Present in PRNS (PRNS 2001). Most occurrences have few plants (CNPS 2001).	Yes
Agrostis blasdalei var. *blasdalei*	Blasdale's bent grass	FSC	Coastal dunes, prairie, bluffs, and scrub.	Known from fewer than 15 occurrences (CNPS 2001). Present in PRNS (PRNS 2001).	No
Agrostis clivicola var. *punta-reyesensis*	Point Reyes bent grass	FSC	Coastal bluffs.	Present in PRNS (PRNS 2001).	No
Alopecurus aequalis var. *sonomensis*	Sonoma alopecurus	FE	Freshwater marshes and swamps; riparian scrub; wet meadows.	Known from fewer than five native occurrences (CNPS 2001). Present in coastal areas of PRNS.	No
Arctostaphylos hookeri ssp. *Montana*	Tamalpais manzanita	FSC	Serpentinite areas in chaparral and valley and foothill grassland	Known from fewer than 20 occurrences (CNPS 2001).	No
Blennosperma nanum var. *robustum*	Point Reyes blennosperma	FSC	Coastal prairie and scrub.	Known from fewer than 15 occurrences; some PRNS populations intermediate to *B.* var. *nanum* (CNPS 2001).	No
Calamagrostis crassiglumis	Thurber's reed grass	FSC	Mesic areas in coastal scrub and freshwater marshes.	Known in California from fewer than 10 occurrences (CNPS 2001). Present in PRNS (PRNS 2001), but threatened by grazing (CNPS 2001).	No
Calochortus tiburonensis	Tiburon mariposa lily	FT	Serpentinite areas in valley and foothill grassland.	Known from only one occurrence at Ring Mountain (CNPS 2001).	No
Campanula californica	swamp harebell	FSC	Bogs and fens; closed-cone and North Coast coniferous forest; coastal prairie; meadows; freshwater marsh.	Mapped in several locations along the western side of Tomales Bay and Inverness Ridge (NDDB 2001).	No
Castilleja affinis ssp. *neglecta*	Tiburon Indian paintbrush	FE	Serpentinite areas in valley and foothill grassland.	Known from six occurrences (CNPS 2001). Not known in PRNS.	No
Castilleja ambigua ssp. *humboldtiensis*	Humboldt Bay owl's-clover	FSC	Coastal salt marsh.	Known only from Humboldt and Marin counties (NDDB 2001).	No
Ceanothus gloriosus var. *porrectus*	Mount Vision ceanothus	FSC	Closed-cone coniferous forest; coastal prairie; coastal scrub; valley and foothill grassland.	Known from fewer than 15 occurrences in the Mount Vision area in PRNS (CNPS 2001; NDDB 2001).	No

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Ceanothus masonii	Mason's ceanothus	FSC	Serpentinite areas in chaparral.	Known from approximately five occurrences; may be a variety of *C. gloriosus* (CNPS 2001). Present in GGNRA (PRNS 2001).	No
Chorizanthe cuspidata var. *cuspidata*	San Francisco Bay spineflower	FSC	Sandy areas in coastal dunes, coastal prairie, and coastal scrub.	Not known from PRNS (PRNS 2001).	Chorizanthe cuspidata does occur
Chorizanthe cuspidata *var.* villosa,	wooly headed spineflower	FSC	Sandy areas in coastal dunes, coastal prairie, and coastal scrub.	Not known from PRNS (PRNS 2001).	Chorizanthe cuspidata does occur
Chorizanthe robusta	Robust spineflower		Coastal sand, scrub.	Known to occur within PRNS	No
Chorizanthe valida	Sonoma spineflower	FE	Sandy areas in coastal prairie.	Thought extinct at one time; only known extant occurrence in PRNS(CNPS 2001; PRNS 2001).	No
Cirsium hydrophilum var. *vaseyi*	Mount Tamalpais thistle	FSC	Serpentinite seeps in broadleafed upland forest and chaparral.	Known from fewer than 10 occurrences on Mount. Tamalpais.	No
Clarkia concinna ssp. *raichei*	Raiche's red ribbons	FSC	Coastal bluff scrub.	Known from only one occurrence near Tomales (CNPS 2001).	No
Cordylanthus maritimus ssp. *palustris*	Point Reyes bird's-beak	FSC	Coastal salt marsh.	Present in several areas in Drakes Estero and Limantour Marsh (NDDB 2001, PRNS 2001).	No
Cordylanthus mollis ssp. *mollis*	soft bird's beak	FE	Coastal salt marsh.	Known from fewer than 20 occurrences (CNPS 2001). Has never been observed in marshes on west coast of Marin and Sonoma counties.	No
Delphinium bakeri	Baker's larkspur	FE	Coastal scrub.	Known from only one occurrence along Salmon Creek (CNPS 2001).	No
Erigeron supplex	supple daisy	FSC	Coastal bluff scrub; coastal prairie.	Possibly extirpated from the area (USFWS April 2001).	No
Erysimum franciscanum	San Francisco wallflower	FSC	Coastal dunes; coastal scrub; often serpentinite or granitic areas in valley and foothill grassland.	Not known from PRNS (PRNS 2001).	No
Fritillaria liliacea	fragrant fritillary	FSC	Often on serpentinite soils in coastal scrub, coastal prairie, and valley and foothill grassland.	Present in PRNS (PRNS 2001, NDDB 2001).	No
Grindelia hirsutula var. *maritima*	San Francisco gumplant	FSC	Sandy, serpentinite soils in coastal bluff scrub, coastal scrub, and valley and foothill grassland.	Present in PRNS (PRNS 2001).	No

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Helianthella castanea	Diablo helianthella	FSC	Broadleafed upland forest; chaparral; cismontane woodland; coastal scrub; riparian woodland; valley and foothill grassland.	Possibly extirpated from the area (USFWS April 2001).	No
Hemizonia multicaulis ssp. *multicaulis*	seaside tarweed	FSC	Coastal grassland, sometimes serpentine; gen <300 m.	Considered but rejected by CNPS for listing because considered synonym of *H. congesta* ssp. *congesta*, a common species (CNPS 2001).	No
Hemizonia multicaulis ssp. *vernalis*	Tiburon tarweed	FSC	Coastal grassland, sometimes serpentine; gen <300 m.	Considered but rejected by CNPS for listing because considered synonym of *H. congesta* ssp. *congesta*, a common species (CNPS 2001).	No
Hesperolinon congestum	Marin dwarf flax	FT	Serpentinite areas in chaparral and valley and foothill grassland.	Present in GGNRA (PRNS 2001). Known from fewer than 20 occurrences (CNPS 2001).	No
Holocarpha macradenia	Santa Cruz tarplant	FT	Often clay and sandy soils in coastal prairie, coastal scrub, and valley and foothill grassland.	Known from fewer than 15 occurrences. Last remaining natural population in San Francisco Bay extirpated in 1993 (CNPS 2001).	No
Horkelia cuneata ssp. *sericea*	Kellogg's horkelia	FSC	Old dunes; coastal sandhills; gen < 200 m.	Not known from PRNS (PRNS 2001). Possibly extirpated from the area (USFWS April 2001). Occurrence from Mt. Bruno area probably last remaining one in San Francisco Bay (CNPS 2001).	No
Horkelia marinensis	Point Reyes horkelia	FSC	Coastal dunes, prairie, and scrub.	Present in PRNS (PRNS 2001). Known from fewer than 20 occurrences (CNPS 2001).	No
Lathyrus jepsonii var. *jepsonii*	Delta tule pea	FSC	Freshwater and brackish marsh.	Has never been observed in marshes on west coast of Marin and Sonoma counties.	No
Layia carnosa	beach layia	FE	Coastal dunes.	Present in PRNS (PRNS 2001).	No
Lessingia micradenia var. *micradenia*	Tamalpais lessingia	FSC	Usually serpentinite areas in chaparral and valley and foothill grassland; often along roadsides.	Known only from four occurrences near Mount Tamalpais (CNPS 2001).	No

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Lilaeopsis masonii	Mason's lileaopsis	FSC	Freshwater and brackish marshes; riparian scrub; in muddy or silty soil formed through river deposition.	Questionable identification of species in 1939; May have been *L. occidentalis*. Hydrology of site since altered (NDDB 2001).	No
Lilium maritimum	coast lily	FSC	Broadleafed upland forest; closed-cone coniferous forest; coastal prairie; coastal scrub; and North coast coniferous forest.	Present in PRNS (PRNS 2001).	No
Limnanthes douglasii ssp. *sulphurea*	Point Reyes meadowfoam	FSC	Coastal prairie; mesic areas in meadows; freshwater marsh; and vernal pools.	Known from approximately 10 occurrences (CNPS 2001). Present in PRNS (PRNS 2001).	No
Lupinus tidestromii	Tidestrom's lupine	FE	Coastal dunes.	Present in PRNS (PRNS 2001).	No
Pentachaeta bellidiflora	white-rayed pentachaeta	FE	Often serpentinite areas in valley and foothill grassland.	Known from only one extended occurrence near Highway 280 on San Francisco Peninsula (CNPS 2001).	No
Perideridia gairdneri ssp. *gairdneri*	Gairdner's yampah	FSC	Mesic areas in broadleafed upland forest, chaparral, valley and foothill grassland, and vernal pools.	Present in PRNS (PRNS 2001).	No
Phacelia insularis var. *continentis*	northcoast phacelia	FSC	Coastal bluff scrub; coastal dunes.	Known from approximately seven occurrences (CNPS 2001). Present in PRNS (PRNS 2001).	No
Plagiobothrys diffusus	San Francisco popcorn-flower	FSC	Coastal prairie; valley and foothill grassland	Known from fewer than 10 occurrences (CNPS 2001). Not known from PRNS (PRNS 2001). Jepson characterized species as indistinct from *P. reticulatus* var. r*ossianorum* (Hickman 1993).	No
Pleuropogon hooverianus	North Coast semaphore grass	FSC	Mesic areas in broadleafed upland forest, meadows, North Coast coniferous forest, and vernal pools.	Known from fewer than 10 occurrences (CNPS 2001).	No
Polygonum marinense	Marin knotweed	FSC	Coastal salt marshes and brackish marshes.	Known from fewer than 15 occurrences; taxonomic status uncertain (CNPS 2001). Present in several locations in the PRNS (PRNS 2001).	No
Rhynchospora californica	California beaked-rush	FSC	Bogs and fens; lower montane coniferous forest; seeps in meadows; freshwater marshes.	Known from fewer than 10 occurrences (CNPS 2001). Last seen in 1945 (NDDB 2001).	No

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Sagittaria sanfordii	Sanford's arrowhead	FSC	Assorted shallow freshwater marshes and swamps.	Not known from PRNS (PRNS 2001).	No
Sidalcea hickmanii ssp. *viridis*	Marin checkerbloom	FSC	Serpentinite areas in chaparral.	Not known from PRNS (PRNS 2001).	No
Stebbinsoseris decipiens	Santa Cruz microseris	FSC	Open areas, sometimes serpentinite, in broadleafed upland forest, closed-cone coniferous forest, chaparral, coastal prairie, and coastal scrub.	Known from fewer than 20 occurrences (CNPS 2001). Not known from PRNS (PRNS 2001).	No
Streptanthus batrachopus	Tamalpais jewelflower	FSC	Serpentinite areas in closed-cone coniferous forest and chaparral.	Known from fewer than 10 occurrences in the Mount Tamalpais area (CNPS 2001).	No
Streptanthus niger	Tiburon jewelflower	FE	Serpentinite areas in valley and foothill grassland.	Known from only three occurrences on Tiburon peninsula (CNPS 2001).	No
Trifolium amoenum	showy Indian clover	FE	Valley and foothill grassland; coastal bluff scrub; sometimes on serpentine soil; open, sunny areas; swales	Last recorded in Olema area in 1886. Thought extinct, but rediscovered twice since 1993: only one extant as of 1996 (CNPS 2001).	No
Triphysaria floribunda	San Francisco owl's-clover	FSC	Serpentinite areas in coastal prairie and valley and foothill grassland.	Present in PRNS (PRNS 2001).	No

FEDERAL STATUS CODES

FEDERAL LISTING

FE = Listed as endangered under federal Endangered Species Act.
FT = Listed as threatened under federal Endangered Species Act.
FD = Delisted from federal Endangered Species Act.
FSC = A USFWS species of concern - formerly a Category 2 candidate for listing.