ENVIRONMENTAL ASSESSMENT

COASTAL WATERSHED RESTORATION – DRAKES ESTERO ROAD CROSSING IMPROVEMENTS

Point Reyes National Seashore

National Park Service

October 13, 2004

Environmental Assessment

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Point Reyes National Seashore proposes replacement or improvements to culverted road crossings at 6 locations within the Drakes Estero Watershed. The need for the project is to repair or replace existing road-crossing facilities (crossings) in a manner that is sustainable ecologically and hydrologically, with infrastructure that will require less maintenance for long-term park operations. Prior to acquisition of the land by the NPS, a network of roads and other infrastructure were constructed to support existing agricultural operations and planned residential development. Culverts comprise many of the park road crossings. Since the Seashore was established, the NPS has continued to manage the existing roads, drainage facilities, and other infrastructure. Many of these facilities are beyond their design life, and are either not compatible with current land use designations (e.g., Wilderness areas) or are in imminent danger of catastrophic failure.

This project focuses on 6 separate crossings of drainages and streams in the Drakes Estero Watershed. These 6 project areas fall within 3 coastal subwatersheds, which eventually drain to Drakes Estero and Drakes Bay. The Mt. Vision Road and Estero Road project areas are located on East Schooner Creek, which parallels Sir Francis Drake. The Upper Home Ranch project area is located on North Home Ranch Creek at its junction with Estero Road. The Lower Home Ranch project area is located on Home Ranch Creek at the Home Ranch facility. The remaining 2 project areas (Upper and Lower Laguna) are located on Laguna Creek, where access to the Laguna Trailhead and Coast Trail cross the stream channel. These creeks are perennial drainages or creeks that have flowing water throughout the year.

The goals of the Drakes Estero Road Crossing Improvements are:

1. To improve or replace road-crossing facilities in poor or failing condition, using design criteria and construction materials that are ecologically and operationally sustainable.

2. To ensure that road-crossing facilities meet fish passage design guidelines to accommodate fish movement within the watershed (NOAA Fisheries 2001; CDFG 2002).

3. To reduce or remove the long-term operations and maintenance requirements associated with each of these park facilities.

4. To ensure that replacement designs increase flow conveyance (to meet the 100-year discharge event [Q100]) to improve or restore natural hydrologic and floodplain processes to these sites.

To accomplish these objectives, the NPS investigated a combination of potential actions or treatments at the 6 road-crossing facilities, including embedded culverts, bottomless pre-cast or metal arch culverts, or conventional bridges in combination with the required grade stabilization. The proposed alternatives synthesize the results of more extensive pre-design investigations. The proposed actions would restore natural hydrologic and geomorphic processes and watershed functions at each of the sites.

Within the project watersheds, impacts associated with farming, dairy, or livestock operation occurred between the 1870s and 1950s. As the history of the Limantour area shows, these areas were divided for development and infrastructure was installed to support a planned community. Each stream crossing remains a part of the Point Reyes National Seashore infrastructure, and is in need of repair or replacement. The design criteria used for this project is consistent with state and federal design guidelines for salmonid fish passage through road crossings. In addition, the project is consistent with NPS management policies (NPS 2000) and park management objectives regarding watershed management. The stream, wetland and riparian habitats within the project area have developed around these structures and are considered stable. Without maintenance, stability could be threatened.

This EA evaluates the potential environmental consequences of 3 alternative strategies for implementing the Coastal Watershed Restoration – Culvert Replacement Project. These alternatives address failing road

culverts in within the project area. Descriptions of the No Action and the 2 Action Alternatives are framed first by a description of existing facilities and their condition at the 6 proposed project sites in Chapter 2.

The proposed project alternatives include:

Alternative A - No Action,
Alternative B - Fish Passage Restoration with Minimal Maintenance, and
Alternative C - Fish Passage Restoration with Long-Term Management Flexibility (Preferred Alternative).

The potential for direct impact, cumulative impact, and impairment of Geology, Geohazards, and Soils; Air Quality; Soundscapes; Hydrologic and Geomorphic Processes, including Water Quality; Impacts to floodplains, wetlands, and riparian zones; Wildlife; Special Status Species, Critical Habitat, and Essential Fish Habitat; Impacts to Cultural Resources; Impacts to Recreational resources, visitor experience, and aesthetic resources; and Impacts to public safety and transportation are evaluated as part of this Environmental Assessment. Special status species, including California red-legged frog (*Rana aurora draytonii, Federally Threatened*) and steelhead (*Oncorhynchus mykiss; Federally Threatened*), as well as impacts to a number of Federal Species of Concern are evaluated as part of this document.

The NPS has selected Alternative C as the preferred alternative to best accomplish the objectives of the project. At four of the six sites, the proposed treatments are the same for both Alternatives B and C. Alternative C meets all of the project criteria regarding improved fish passage and stream conveyance, reduces long-term operations and maintenance requirements, but does not preclude the ability of park managers from addressing larger scale planning issues associated with the General Management and Wilderness planning processes.

1.0 Purpose and Need

1.1 Introduction

The Coastal Watershed Restoration Program - Drakes Estero Road Crossing Improvements 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 replacement of road crossing facilities at 6 sites within the Drakes Estero watershed of Point Reyes National Seashore (PRNS). NEPA was implemented to provide a framework for the public to evaluate proposed actions or projects on the basis of their impacts to the "human environment." Environmental Assessments are intended for larger projects whose impacts are either unknown and require study or whose impacts are considered less than significant. This EA examines alternative means to restore hydrologic and geomorphic processes and watershed functions at these sites and assesses the potential environmental effects that would occur with implementation of each strategy. Following public and agency review and comment, the conclusions of potential environmental effect in the EA will be used to guide the NPS planning process. In keeping with the intent of NEPA, this EA may identify the need for further environmental review through an Environmental Impact Statement (EIS) or may lead to a decision that the project's impacts are adequately assessed in conformance with NEPA and are less than significant through either avoidance or mitigation of impacts. 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 the 6 culvert crossing locations.

1.2 Project Need

The need for the project is to repair or replace existing road-crossing facilities (crossings) in a manner that is sustainable ecologically and hydrologically, with infrastructure that will require less maintenance for long-term park operations. Prior to acquisition of the land by the NPS, a network of roads and other infrastructure were constructed to support existing agricultural operations and planned residential development. Culverts comprise many of the park road crossings. Since the Seashore was established, the NPS has continued to manage the existing roads, drainage facilities, and other infrastructure. Many of these facilities are beyond their design life, and are either not compatible with current land use designations (e.g., Wilderness areas) or are in imminent danger of catastrophic failure. To this end, the NPS has been developing a number of projects aimed at removing ranch roads or upgrading or removing culverts and other stream-crossing infrastructure. These projects, including the Drakes Estero Road Crossings Improvement Project, fall under the Seashore's Coastal Watershed Restoration Program.

This project focuses on 6 separate crossings of drainages and streams in the Drakes Estero Watershed (Figure 1.1). These 6 project areas fall within 3 coastal subwatersheds, which eventually drain to Drakes Estero and Drakes Bay. The Mt. Vision Road and Estero Road project areas are located on East Schooner Creek, which parallels Sir Francis Drake. The Upper Home Ranch project area is located on North Home Ranch Creek at its junction with Estero Road. The Lower Home Ranch project area is located on Home Ranch Creek at the Home Ranch facility. The remaining 2 project areas (Upper and Lower Laguna) are located on Laguna Creek, where access to the Laguna Trailhead and Coast Trail cross the stream channel. These creeks are perennial drainages or creeks that have flowing water throughout the year. None of the project sites documented as part of this project are within designated wilderness areas.

The 6 project areas have been identified by the NPS as having culverts and other infrastructure that are beginning to degrade and/or are undersized for even small to moderate streamflow events (NHC 2002). With the exception of Upper Laguna, the 6 project areas have undersized culverts. When culverts are undersized, streamflow during flooding events starts to back up within the channel, sometimes exacerbating the extent of upstream flooding. The velocity or speed of water within the culvert itself increases, and so does the erosive power of the water downstream of the culvert, leading to horizontal erosion or widening of the downstream channel banks and downcutting or vertical erosion of the streambed itself. This problem is most evident at the Mt. Vision and Estero Road crossings. In addition, undersized culverts have caused

flood flows to overtop roads, even during small storm events, thereby decreasing accessibility to private inholdings or park facilities needing maintenance. There are other problems, as well. The culvert inlet at the North Home Ranch has subsided or dropped in elevation relative to the outlet, creating an uphill gradient within the culvert and reducing its ability to effectively pass storm flows. At Lower Laguna, sediment deposition within the culvert has effectively reduced the capacity of the 6-foot facility by almost 50%.

Even more importantly, some of the crossing facilities are in imminent danger of catastrophic failure. At the Mt. Vision road crossing, water is piping around the culvert (flowing on the outside and inside of the culvert). The crossing at Estero Road is beginning to erode and threaten the integrity of the road. Should these facilities catastrophically fail, access to homes and park facilities could be cut off, and public and employee safety could be jeopardized.

The impacts from these failing culverts are not restricted just to localized erosion, downcutting, or potential failure problems. Degraded infrastructure can cause larger-scale impacts through impairment of hydrologic and geomorphic processes and watershed functions. Watersheds comprise integrated stream and upland areas whose waters and sediments drain to a common destination. The movement of water and sediment through the watershed system relies upon hydrologic, geomorphic, and sediment transport processes. These processes include flooding, surface water interaction with the groundwater table, horizontal movement or meandering of the creek channel, connectivity of the stream with the floodplain, and the movement of boulders, gravel, and fine sediment, etc.

These processes determine to a large extent the functions that are played by watersheds, many of which directly benefit people, as well as wildlife and flora. Beneficial watershed functions include the potential for creeks to provide floodwater retention, decrease the erosive energy of flood flows, improve water quality, support riparian vegetation and wetlands, and provide habitat for wildlife such as neotropical migrant birds, frogs, and fish. Downcutting of the streambed below culverts has isolated many of these creeks from their historic floodplains, decreasing the ability of these areas to provide floodwater retention. This disconnection between creek and floodplain has also had negative impacts on the riparian habitat and wetlands. When the vertical distance between the top of the bank and the streambed becomes too great, riparian and wetland habitats start to die or evolve into upland habitats because the groundwater table has been lowered below the rooting zone of water-adapted plant species. Isolation from the floodplain also reduces the ability of the riparian habitat to decrease the velocity and erosive force of flood flows and improve water quality by "filtering" sediment and nutrients in the water.

Streams also provide important habitat for wildlife species. Not only do they support aquatic species such as frogs, amphibians, reptiles, and fish, they provide breeding and foraging habitat for birds and act as important migration corridors for terrestrial species. For special status anadromous species such as steelhead trout (*Oncorhynchus mykiss;* federally Threatened) and coho salmon (*Oncorhynchus kisutch;* federally Threatened), coastal streams are a crucial link in the species' life cycle. Steelhead and coho were once common in central California coastal creeks, but their numbers have dwindled dramatically in recent decades due to a number of potential factors, including hydrologic alterations to rivers and creeks, overfishing, and changes in oceanic conditions. Numbers of coho salmon are estimated to be at 1% of the estimated historic population (Brown and Moyle 1991). The watersheds of coastal Marin County supports one of the largest remaining populations of coho salmon within the Central Coast Evolutionarily Significant Unit (ESU) estimated at 15-20% of the population.

Three of the project subwatersheds, East Schooner Creek, Home Ranch Creek, and Laguna Creek currently support steelhead trout. While coho salmon have not been observed, the NPS believes that these subwatersheds could also support coho salmon, and is considered Essential Fish Habitat for coho salmon as defined by the Magnuson-Stevens Fishery Conservation and Management Act. Because of the infrastructure problems, however, the potential for these creeks to support large, sustainable populations of either species is low. The existing culverts not only impede natural hydrologic process, but in many cases, prevent passage of anadromous fish species. Anadromous species such as steelhead and coho spend approximately half of their lives in the freshwater stream system and half in the ocean. While the migration of adults returning to the freshwater stream from the ocean to spawn and eventually die is a well-known

story, the ability of juvenile fish to move without impediment within the stream system is just as important to the health and survival of the species.

Most commonly, the outlet of a culvert is considered an impediment or barrier. Culverts can also affect the ability of fish, and many other species, to move through them based on other parameters, including velocity, length, and inlet (upstream) conditions. A culvert that allows adults through, may still remain a barrier to juvenile salmonids that would otherwise use upstream habitat for refugia under higher winter flow conditions. While emphasis is often focused on salmonids, culverted road crossings are also barriers to the other aquatic species in the stream system. The road crossing design criteria area (NOAA Fisheries 2001; CDFG 2002) would create suitable conditions, not only for adult and juvenile salmonid passage, but potentially for other aquatic species in the stream system.

Degradation of the stream channels at the culvert crossings has hindered fish passage in many ways. Excessive scouring and downcutting of the channel downstream of the culvert invert has not developed an adequate step- or drop-pool structure that would enable anadromous species to clear the elevation drop between the channel invert or bottom and the downstream channel. In some of these locations, the elevation drop is as great as 5 feet. Even if some fish are able to clear the drop, the excessive velocities and lack of baffling within the culverts often sweep them back downstream. In addition to the passage problems, excessive erosion of stream banks increases the amount of fine sediment within stream waters that could potentially be deposited in gravelly areas and impact spawning. Anadromous species are also temperature sensitive. Riparian habitat provides the shade needed to keep water temperatures low for juveniles that mature in pools within freshwater streams before they migrate out to the ocean. Loss of riparian habitat due to channel widening and downcutting could decrease canopy cover and elevate water temperatures.

Long-term, fish habitat recovery and other watershed functions, such as floodwater retention and water quality improvement, will not be able to proceed unless constructed facilities are improved and natural processes restored. Restoration of hydrologic, geomorphic and sediment processes will lead to floodwater retention and water quality improvement.

The culvert improvement project will maintain existing access to ranches, facilities and trailheads. The Estero Road, North Home Ranch and Home Ranch crossings provide access to the historic Home Ranch, which is still under lease. Mt. Vision Road crossing provides access to park residences, numerous vistas and trailheads, as well as the Federal Aviation Administration (FAA) transponder site. Estero Road and Lower and Upper Laguna crossings also enable park staff and visitors to access the Estero trailhead, Coast Camp, Coast Trail, Laguna Trail, and park housing. While trailheads do not necessarily require crossing facilities, vehicular access to Coast Camp and park housing needs to be maintained for operational and maintenance purposes.

1.3 Project Purpose

The purpose of this project is to repair or replace existing road crossing infrastructure in a manner that facilitates or improves natural hydrologic and geomorphic processes within watersheds of Drakes Estero known to support federally threatened central California steelhead. While the NPS has historically focused on preservation and conservation rather than restoration, it has come to realize that preservation may not be enough to fulfill the mandates of the Organic Act or the enabling legislation of many of the park units. Without some action, many valued NPS assets may continue to degrade or even cease to exist. Recent management policies acknowledge this need to move beyond simple preservation by encouraging parks to restore natural systems and their associated processes, functions, and values.

The NPS should “manage watersheds as complete hydrologic systems..... (and to) achieve the protection of watershed and stream features .... by allowing natural fluvial processes to proceed unimpeded” (NPS 2000, § 4.6.6). Specifically, parks should work 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 .....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, § 4.1.5).

In addition, the NPS is directed to manage for the preservation of floodplain values such as those afforded by creeks within the project subwatersheds (NPS 2000, § 4.6.4). Wetlands are present within each of the 6 road-crossing locations. “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 pre-disturbance conditions” (NPS 2000, § 4.6.5).

Restoration of water resources and aquatic habitat have been identified as a high priority objectives by the NPS in the PRNS General Management Plan (NPS 1980), the PRNS Resource Management Plan (NPS 1999), and the NPS Management Policies (NPS 2000). The current PRNS General Management Plan (NPS 1980) and Statement for Management (NPS 1993) 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 cultural and historic resources and the diversity of natural ecosystems representative of the California coast (NPS 1993).

The NPS has evaluated each of these crossings and determined them to be necessary to park operations or visitor needs. Where possible, the NPS, however, does remove facilities to implement restoration (e.g., Muddy Hollow trail crossing of Muddy Hollow Creek). This approach is consistent with NPS management guidelines that require that “NPS managers will first consider relocating or redesigning facilities, rather than manipulating streams” (NPS 2000, § 4.6.6). In addition, management policies note that “when it is not practicable to locate or relocate development…to a site outside and not affecting the floodplain the Service will… ensure that structures and facilities are designed to be consistent with the intent of the standards and criteria of the National Flood Insurance Program” (NPS 2000, § 4.6.4).

In addition to the purpose, the NPS has established some specific objectives for this project. These translate the project purpose into specific objectives that were incorporated into project design.

The goals of the Drakes Estero Road Crossing Improvements are:

1. To improve or replace road-crossing facilities in poor or failing condition, using design criteria and construction materials that are ecologically and operationally sustainable.

   The condition of road-crossing facilities has been evaluated by both NPS and an analysis by independent consultant, Northwest Hydrologic Consultants (NHC 2002). The durability of road-crossing facilities can be improved by not only redesigning these facilities (i.e., placing footings outside the average annual high flow), but by using different more durable materials that have a longer design life. For example, cement has a longer design life in corrosive marine environments. The proposed design criteria will improve both the ecological and operational sustainability of the facilities repaired or replaced as part of this project.

2. To ensure that road-crossing facilities meet fish passage design guidelines to accommodate fish movement within the watershed (NOAA Fisheries 2001; CDFG 2002).

   Because road-crossing facilities are one of the major hindrances to migration of threatened and endangered fish species, state and federal agencies have developed guidelines for construction or repair of facilities that would improve the ability of creeks to accommodate fish passage. National Oceanic and Atmospheric Administration (NOAA) Fisheries has also put together a set of guidelines for road-crossing facilities, National Marine Fisheries Crossing Guidelines (NOAA Fisheries 2001). In 2002, the Department of Fish and Game released similar guidelines specific to needs within the state of California (CDFG 2002). To the extent possible, alternatives presented in this EA comply with guidelines of both of these agencies. Detailed descriptions of these guidelines are provided in Chapter 2.

3. To reduce or remove the long-term operations and maintenance requirements associated with each of these park facilities.

   The NPS has identified sustainability as one of the major objectives of infrastructure construction, repair, and replacement projects. Not only is maintenance costly, but maintenance projects typically have some impact on the environment, requiring disturbance to creeks, water flows, riparian habitat, and wildlife. Minimizing the amount and degree of maintenance required through appropriate design and selection of materials is a goal of this project.

4. To ensure that replacement designs increase flow conveyance (to meet the 100-year discharge event [Q100]) to improve or restore natural hydrologic and floodplain processes to these sites.

   During winter storm events, stream flow can increase dramatically. The amount of water coming down a stream during a storm depends upon how much rain and associated run-off from surrounding uplands occur. Modeling of flow capacity and velocities predicted within the existing culverts was conducted for each of the project sites as part of the initial investigations (NHC 2002). These surveys determined that the road-crossing facilities currently only allow some of the smaller flood flows to pass through unimpeded -- typically the annual to 10-year flooding events. During higher flows, waters flow over the road or back up the stream, creating considerable upstream flooding of the road-crossing facility. The velocity and energy of these flood flows is also increased downstream from the culvert by the constricting effect the culvert or bridge. These conveyance problems disrupt sediment transport and distribution patterns resulting in downcutting of the channel bed, creek-bank erosion , elimination of fish habitat, and deposition of excessive amounts of upstream sediment. Many of these problems can be eliminated by designing road-crossing facilities that allow larger flooding events to pass through unimpeded. While the NPS only encourages parks to design for the 50-year flow, the NOAA and CDFG fish passage guidelines urge agencies and private landowners to design for the 100-year event. Where possible, the NPS has selected passage of the 100-year flooding event as one of the design goals of this project.

To accomplish these objectives, the NPS investigated a combination of potential actions or treatments at the 6 road-crossing facilities, including embedded culverts, bottomless pre-cast or metal arch culverts, or conventional bridges in combination with the required grade stabilization. The proposed alternatives synthesize the results of more extensive pre-design investigations. The proposed actions would restore natural hydrologic and geomorphic processes and watershed functions at each of the sites.

Funding for this project has been obtained from the NPS Line-Item Construction Program. The passage by Congress of the Government Performance Results Act of 1993 (GPRA) mandated that the NPS and 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.”

1.4 Projects Considered in Cumulative Impacts Analysis

The proposed project is one of several planned water resource restoration projects that are proposed for the enhancement or restoration of PRNS water resources. For this analysis, the cumulative effects are evaluated where direct impacts may occur within the Drakes Estero/Drakes Bay watershed. The planning horizon for this cumulative analysis anticipates potential projects that may be implemented within the next 5 years, to 2009. It should be noted that Best Management Practices (BMP) and environmental commitments developed in this EA for the road-crossing improvements may provide valuable protocol for subsequent implementation of the other restoration efforts. These other projects include:

- Coastal Watershed Enhancement Project – Geomorphic Restoration – This project includes the restoration of natural hydrologic process through removal of dams or road crossings at 3

sites within the Drakes Estero Watershed. The project is in the planning Phases, with Environmental Assessments to be released by summer 2004. The watershed enhancement will require state and federal permits similar to those required for this project.

- Horseshoe Pond Restoration to Coastal Lagoon – This project involves the removal of spillway and dam materials to restore natural hydrologic and shoreline process to a 35-acre area just west of the mouth to Drakes Estero. In addition the project will restore or enhance the access road, borrow quarry, and former waste lagoon to more natural conditions. The project planning and implementation are scheduled for completion by fall 2004. The pond restoration will require state and federal permits similar to those required for this Project.

- 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. The project planning and implementation are anticipated to be completed by summer and fall 2005. The dam and quarry restoration will require a number of state and federal permits, and 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 used at a larger scale under a Line-Item Construction project planned for FY 2007.

- Fire Management Program – PRNS has completed a Fire Management Plan and is conducting an environmental analysis. 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 are 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. A final Environmental Impact Statement (EIS) is expected summer 2004 and the NPS anticipates implementation to start in FY2005.

- General Management Plan – PRNS 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.

- Giacomini Wetland Restoration Project – PRNS and Golden Gate National Recreation Area (GGNRA) are conducting a large-scale wetland restoration project at the southern end of Tomales Bay. This project would restore natural hydrologic and ecological processes and functions to the historic tidal marsh, which was leveed in the 1940s for operation of a dairy ranch. The project is currently in the alternatives development phase. A draft EIS/Environmental Impact Report (EIR) is scheduled for 2005, with possible implementation of a portion of the project in late 2006.

1.5 Issues Raised during Project Scoping

1.5.1 Public Scoping

Project scoping was conducted between June 10, 2002 and July 10, 2002. The public scoping document was mailed to the park's public outreach mailing list, which includes more than 200 recipients. Two letters regarding this project were received. One letter expressed support for the project and proposed actions. The other questioned whether the project would be able to achieve its purpose without remedying problems at other crossings within the subwatersheds, specifically the East Schooner Creek and Laguna subwatersheds. Those issues raised that have potential for effect are addressed in this EA.

1.5.2 Internal Scoping

The NPS has conducted internal staff scoping, as well as public scoping for this project. In internal scoping, the NPS examines potential environmental issues relevant to the proposal that are raised by NPS staff. Those relevant issues with potential for effect are addressed in this EA.

1.6 Impact Topics Addressed in the EA

The purpose of an EA is to identify whether or not a proposal could have a significant effect on the environment. The significance of an impact is specifically defined either qualitatively or quantitatively for each impact topic and ranges from no impact to major impact. While the definition of negligible, minor, and moderate varies according to impact topic, those with negligible, minor, or moderate impacts are typically those in which impacts are not measurable or detectable or if they are measurable, are not necessarily "significant" or "major." The following impact topics were determined through scoping to have the potential for negligible to moderate impact on the environment. They comprise the impact topics to be addressed in the EA.

Geology and Soils. PRNS is geologically unique, with geologic conditions largely defined by movement of the Pacific and Continental plates along the San Andreas Fault and conversion of marine to terrestrial environments through uplifting. This geology has created a mosaic of soil complexes and bedrock formations within PRNS lands. Project implementation would require the use of heavy equipment to remove and replace culvert facilities from streambeds, creeks and banks, thereby disturbing soils, but not bedrock, in these areas. The proposed actions would require excavation and/or fill in streambed and channel banks. The proposed actions could result in increased erosion and changes to existing topography. At 3 of the 6 locations, treatment alternatives would remain within the existing culvert footprint, while at the other 3 sites, construction activities would require installation of permanent structures in the stream bed upstream and downstream of existing infrastructure. The potential effect of proposed actions on site soils and topographic features will be addressed in this EA.

Geohazards. The proximity of the San Andreas Fault, coupled with the presence of the Pacific Ocean and Tomales Bay, creates an environment with potential for geohazards. The proposed actions would have negligible effects on geohazards. By improving flow conveyance, the new facilities would reduce the risk of landslides and debris flow hazards. The engineered design of the proposed culverts addresses stability and structure with regard to earthquake hazard. These upgrades would replace older facilities originally constructed without consideration of geohazards. Because lands within Point Reyes National Seashore are tectonically active, there is a potential for a catastrophic earthquake that could result in adverse impacts to road facilities and associated resources, regardless of culvert design. The potential effect of the proposed actions on geohazards will be addressed in this EA under Geology and Soils.

Air Quality. While air quality within the marine influenced portion of rural West Marin appears to be above average, air quality can be negatively affected by activities both inside and outside of PRNS. The use of heavy equipment during culvert replacement activities would increase short-term production of pollutants, such as exhaust and dust. Locally generated pollution and dust would disperse quickly due to coastal wind, and would be a negligible contribution to air basin air quality. The action alternatives incorporate sufficient standard Best Management Practices to control visible dust during ground disturbance and to assure that potential effects would be negligible. Potential effects to air quality would be short-term and confined to the construction period. The potential effect of the proposed actions on air quality will be addressed in this EA.

Soundscapes. One of the intrinsic values of national parks is the lack of urban noise and the potential for hearing "natural" noises such as crashing waves or singing birds. Construction projects have the potential to impact park soundscapes. Heavy equipment use would temporarily disrupt natural quiet in the project areas for 2 to 4 weeks during construction activities. The NPS will implement standard Best Management Practices (BMPs) to avoid or minimize noise disturbance to park visitors. There are no permanent facilities such as trailheads, visitor centers, or campsites that would be subject to project noise during the month-long

implementation phase. The potential effect of the proposed actions on soundscapes will be addressed in this EA.

Water Quality and Streamflow Characteristics. The complex geologic setting of PRNS has resulted in an equally complex hydrologic setting, characterized by tides, creeks with seasonal and perennial water flow, and abundant groundwater either in below-ground as aquifers or in ground-level seeps and springs. The project is focused on improving natural hydrologic and geomorphic processes at the 6 road-crossing facilities. In the long term, the proposed actions would have a beneficial effect on streamflow characteristics by improving flow conveyance and sediment transport and by decreasing the amount of bank erosion and downcutting in the streambed. However, there may be temporary adverse impacts to water quality and streamflow characteristics during and shortly after construction, although the NPS will try to minimize impacts by requiring the contractors to implement BMPs. Because this project has the potential to have at least a temporary, adverse impact on water quality, the NPS will seek a permit for the proposed actions from the California Regional Water Quality Control Board, San Francisco District, as required by Section 401 of the federal Clean Water Act. The potential effect of the proposed actions on hydrologic and geomorphic processes, including streamflow characteristics and water quality, will be addressed in this EA under Hydrologic and Geomorphic Processes, including Water Quality and Streamflow Characteristics.

Marine and Estuarine Resources. The proposed project areas are not within marine or estuarine systems. However, these road-crossings occur upstream of Drakes Estero, a large estuarine complex and some of the project sites are within the Coastal Zone boundary. The potential impacts could a beneficial effect on anadromous fisheries due to improved passage conditions in some of the subwatersheds. However, as discussed under Hydrologic and Geomorphic Processes, the project could have a temporary and adverse effect on the quality of water that flows into the Estero due to construction activities. The NPS believes that the proposed rerouting of the stream during construction, as well as other mitigation measures or environmental commitments, would eliminate or substantially reduce the effects on water quality to a negligible level. The potential effect of the proposed actions on marine and estuarine resources will be addressed in this EA under Hydrologic and Geomorphic Processes, including Water Quality, as well as Wildlife.

Floodplains, Wetlands, and Riparian Zones. Floodplains, wetlands, and riparian habitats are integral components of many watershed functions, such as reduction of flood flow velocity, water quality improvement, food support for aquatic organisms, and wildlife habitat. The value and importance of these functions for both people and wildlife may represent one of the primary reasons that impacts to wetlands and their watersheds have become more closely regulated in recent decades. The proposed actions would generally improve the condition of floodplains, wetlands, and riparian habitat, although the extent of wetlands and riparian habitat upstream of infrastructure might decrease. In some of the project areas, undersized culverts have caused "backwater flooding," which has unnaturally widened floodplain and wetland and riparian areas.

Wetlands and some riparian zones 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. Because this project has the potential to adversely impact wetland habitats and those riparian zones that meet the definition of wetlands, the NPS will be seeking a permit from the U.S. Army Corps of Engineers (the Corps), in accordance with Section 404 of the federal Clean Water Act. This project would also require a consistency determination from the California Coastal Commission. Through Directors Order 71-A, the NPS has established policy and guidelines to comply with Executive Order 11990. The potential effect of the proposed actions on Floodplains, Wetlands, and Riparian zones will be addressed in this EA.

Rare or Unusual Vegetation. PRNS has an amazing diversity of vegetation communities and plant species. The project would cause no changes to vegetation communities other than wetlands and riparian habitat. Potential effects on those communities will be are discussed under Floodplains, Wetlands, and Riparian Zones. The potential for impacts to special status plant species would be associated entirely with wetland and riparian habitats and are therefore also addressed in this section of the EA.

Introduction or Spread of Non-Native or Invasive Species. The high biodiversity of PRNS is threatened by the introduction and spread of non-native species. Ground disturbance associated with the proposed actions has the potential to increase non-native plant species at the project sites. The project sites are small, and botanical surveys did not reveal the presence of invasive species within any of the sites that could potentially be spread to another site within the park. However, seeds or vegetative fragments of invasive plants could be spread by construction equipment. The NPS would require that contractors use machinery and materials that is weed free to the maximum extent practicable. The potential for the proposed actions to introduce or spread non-native species would be associated entirely with wetland and riparian habitats, and are therefore addressed under Floodplains, Wetlands, and Riparian Zones.

Species of Special Concern and Critical or Essential Habitat. PRNS supports more than 100 special status plant and wildlife species. While no rare plants were documented in the project areas, they support a few special status 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 (USFWS). Based on site surveys and document review, the NPS determined that the project could impact the following wildlife species and habitats:

- Coastal California steelhead (*Oncorhynchus mykiss,* federally listed Threatened Species; FT)
- Essential fish habitat for coho salmon (*Oncorhynchus kisutch*; federally listed Threatened Species; FT).
- California red-legged frog (*Rana aurora draytonii,* federally listed Threatened Species; FT)
- Breeding habitat for listed neotropical migrant bird species and habitat protected by the Neotropical Migratory Bird Act.

One of the goals for the proposed actions is to restore conditions for anadromous species (such as steelhead and coho salmon) by improving the potential for upstream passage or migration to spawning grounds and juvenile summer habitat. While this project has the potential to increase riparian zones and wetlands downstream of road crossings, a potential decrease in the amount of wetlands and riparian areas upstream of these facilities (see Floodplains, Wetlands, and Riparian Zones) might impact California red-legged frog populations present. There would also be temporary, adverse impacts from construction activities, including rerouting of channel flows, removal of riparian vegetation, and disturbance of streambeds and wetlands. The NPS will take several mitigation measures to minimize construction impacts on special status species and other organisms.

Because the proposed project has the potential to cause a temporary, adverse impact on federally listed species, the NPS will consult with the U.S. Fish and Wildlife Service (USFWS), in accordance with the federal Endangered Species Act. The potential effect of proposed actions on plant and wildlife species of special concern and on critical or essential habitat will be addressed in this EA under Floodplains, Wetlands, and Riparian Zones and Wildlife.

Cultural Resources. The Seashore's history of Native American settlement, European exploration and colonization has left a legacy of valuable archeological and historic resources. An archaeological resources study, undertaken in consultation with the Federated Indians of Graton Rancheria (FIGR), did not identify archaeological resource sites within the project planning areas (Newland 2004). However, historic resources were observed at or near North Home Ranch and Upper Laguna Creek Crossings of the project areas. The NPS proposes to preserve historic resources at these locations. In addition, the Home Ranch Creek crossing occurs within the main Home Ranch historic complex, though the existing culvert (installed in the early 1980s) is not considered part of this complex. The potential effect of the proposed actions on cultural resources and the effectiveness of proposed measures for protection will be addressed in this EA.

Public Safety and Transportation. PRNS is not only is a National Seashore but also home to park staff and agricultural permittees. A number of private commercial and residential properties directly adjoin PRNS. Staff and local residents access their homes and businesses using the same main thoroughfares as

park visitors, principally Bear Valley Road, Sir Francis Drake Boulevard, and Limantour Road. The proposed actions would temporarily affect transportation in PRNS and the vicinity by increasing construction-related traffic and potentially closure of access roads. These transportation impacts would not only affect park visitors (Recreational Resources, Visitor Experience, and Aesthetic Resources), but residents of park housing, residents and staff of NPS-leased ranches (including Home Ranch), emergency personnel, and members of the local community. In addition, the proposed project might have short-term and long-term impacts on public safety since replacement of infrastructure would potentially reduce the risk of catastrophic failure, road flooding, and construction-related hazards associated with frequent repair and maintenance. The potential effect of proposed actions on public safety and transportation will be addressed in this EA.

Recreational Resources, Visitor Experience, and Aesthetic Resources. Park visitors expect national parks to provide beauty, a sense of quiet, and places to enjoy hiking, bird-watching, and other recreational pursuits. The proposed project would have short-term impacts on park visitors by increasing traffic and potentially causing traffic delays, closure of access roads and trail detours. In the long term, the proposed actions would increase the aesthetic appeal of road crossings, decrease the amount of unsightly bank erosion and riparian loss, and improve visitor experience. The potential effect of proposed actions on recreational resources, visitor experience, and aesthetic resources will be addressed in this EA.

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. Through project scoping, it was determined that the proposed actions would have no effect or very negligible effects on the impact topics listed below.

Land Use. The project sites are located in the Drakes Estero watershed of Point Reyes National Seashore. Historically, these areas were agricultural. However, since establishment of the park, in addition to accessing agricultural lands, these road facilities now provide access to park overlooks, trailheads, and residences. Under all proposed actions, including the No Action Alternative (Alternative A), use of the access roads addressed in this project will remain. Under the Alternative A, if the crossing facilities failed, current land use patterns could be disrupted temporarily until emergency repairs could be completed. The project would not change the current long-term land use pattern within the project area.

Unique Ecosystems, Biosphere Reserves, World Heritage Sites. The project sites are located along the coastal margin of the Golden Gate Biosphere Reserve. The proposed actions would have only a negligible effect on the Golden Gate Biosphere Reserve.

Socioeconomics. The project would not affect socioeconomic resources within the local area or region. The restoration activities would not change the natural character or status of areas or have ramifications for the local economy of the local gateway community.

Minority and low income populations. The proposed actions would not result in changes to user demographics, including minority or low-income user groups.

Energy resources. The proposed actions would only have a negligible effect on the sustained use of energy.

Other Agency and Tribal Land Use Plans. The potential effect of the proposed actions on lands of interest to the Federated Indians of Graton Rancheria is discussed under Cultural Resources in Section 1.6.

Prime and Unique Farmlands. Prime and unique farmlands are defined as areas having soil types considered to be productive, of agricultural value, and worthy of conservation. On a federal level, prime and unique farmland soil types are designated by the National Resource Conservation Service (NRCS). On a state level, the California Department of Conservation (CDC) and some California counties have identified additional soil types and management practices that qualify as Farmland of Statewide and Local Importance soils. The project area does not occur within areas mapped by the National Resource

Conservation Service or the California Department of Conservation as having prime and unique farmland or Farmland of Statewide or Local Importance soil types.

1.8 Environmental Compliance Requirements

1.8.1 Laws, Regulations, and Policies

This section describes the legal context and important NPS policies that direct NPS actions relevant to the Coastal Watershed Restoration – Drakes Estero Road Crossing Improvements Environmental Assessment. Legislation specific to PRNS and NPS Management Policies is discussed in Chapter 1, Section 1.3, Project Purpose.

1.8.2 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 National Park Service with the National Park Service 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 National Park Service 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 National Park Service 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.

National Park Service 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.

1.8.3 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 National Park Service 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 the National Environmental Policy Act (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 define 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 (the Corps) 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.

Coastal Zone Management Act. This act protects coastal environments and transfers regulatory authority to the states and excludes federal installations from the definition of "coastal zone." Activities taking place on federal lands and within the coastal zone boundary, 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 (CCC). The NPS will make a determination of consistency and submit it to the CCC for concurrence.

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 threatened or endangered species that are likely to be affected by the proposed action. The National Park Service has initiated consultation with the USFWS and NMFS regarding this project.

1.8.4 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 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 protects archeological resources on public or Native American lands and fosters increased cooperation and exchange of information between private, government, and the professional community to facilitate enforcement and education. It regulates excavation and collection on public and Native American lands. Prior to issuance of a permit, it requires notification of tribes who may consider a site of religious or cultural importance. The act was amended in 1988 to require survey plans for archeological resources on public lands. It also facilitates the reporting of 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 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), Native American 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 for compliance with National Historic Preservation Act, and stipulates the identification, evaluation, treatment, and mitigation of adverse effects for actions affecting historic properties. This project will be submitted to SHPO for review and concurrence.

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

1.8.5 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 (Directors Order 77-2).

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 their natural and beneficial values. If a proposed action is found to be in a wetland, the agency shall prepare a wetland assessment, known as a Statement of Findings (Directors Order 77-1).

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 proposed project include measures to prevent the introduction and spread of invasive species.

1.8.6 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 will 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 that it requires 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 remain in a

natural state to the greatest extent possible, and that recreation uses be of 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 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. The Coastal Watershed Restoration project is identified in the RMP.

PRNS General Management Plan Update. An update the 1980 PRNS General Management Plan (GMP) is in progress; scoping for the GMP update has been conducted. The planning process is expected to take 4-5 years. The Coastal Watershed Restoration 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 Coastal Watershed Restoration, through NEPA and NPS planning processes.

2.0 Description of the Project Alternatives

This EA evaluates the potential environmental consequences of 3 alternative strategies for implementing the Coastal Watershed Restoration – Culvert Replacement Project. These alternatives address failing road culverts in within the project area. Descriptions of the No Action and the 2 Action Alternatives are framed first by a description of existing facilities and their condition at the 6 proposed project sites. This discussion is followed by a detailed description of the 3 alternatives:

A. No Action,
B. Fish Passage Restoration with Minimal Maintenance, and
C. Fish Passage Restoration with Long-Term Management Flexibility (Preferred Alternative).

At 4 of the six project sites, proposed treatments are common among both action alternatives. These sites and actions are described in section 2.4 - Elements common to all action alternatives.

2.1 Existing Facility Conditions

All sites described in this Environmental Assessment lie within watersheds that drain into Drakes Estero and Drakes Bay at Point Reyes National Seashore. For more information regarding the natural and cultural setting of the proposed Project, see Chapter 3 of this document, Project Setting and Affected Environment.

Each of the 6 project sites described below contains an undersized or failing culvert facility beneath a park access road currently deemed integral to park operations. The culverts are described by their condition, and their capacity to accommodate flood flows of a specific return probability (Table 2.1). For example, the Upper Laguna culvert has a capacity to convey flows that would occur during a 100-year flow event. Other culverts are dramatically undersized, and would be overtopped during more frequent flooding events. As an example, the North Home Ranch culvert is estimated to overtop under only the estimated 2-year discharge event.

2.1.1 Mount Vision Crossing

The culvert at the intersection of Mount Vision Road and East Schooner Creek is a 48-inch diameter, 24-foot long corrugated metal pipe. The culvert, installed in the early 1980s, is now in poor condition. The culvert is capable of conveying 2-year flow events, but is overtopped during 10-year flow events. During previous high flow events the constricting culvert has created a backwater pool immediately upstream of the road crossing, forcing runoff over the road. The culvert is undermined by water piping underneath it. The lack of conveyance capacity has caused sediment deposition upstream , and severe erosion directly downstream. The stream profile drops approximately 5 feet at the culvert outlet, and 2 large eroded gullies parallel the main channel for over 100 feet downstream of the road crossing. The steep drop-off at the culvert's outlet has been filled with riprap to protect structural integrity, however, this creates a barrier to movement of aquatic organisms. In addition, the increased erosion, sediment movement, and downstream channel bed changes associated with this culvert may adversely impact aquatic organisms.

2.1.2 Estero Crossing

The culvert at the intersection of Estero Road and East Schooner Creek is a 57-inch high, 83-inch wide corrugated metal pipe arch. The 24-foot long culvert conveys the creek beneath Estero Road. The culvert is in poor condition: the culvert arch was been deformed at some time since its installation, and the culvert has been observed to flex when larger vehicles drive over the structure. In addition, the culvert is undermined by water piping underneath the culvert, resulting in road prism instability and slope failure. This culvert is capable of accommodating a 100-year flow event. However, despite its adequate capacity, the poor condition of the structure has caused a 36-inch drop-off and scour pool at the culvert outfall. This

steep change in topography impedes migration of aquatic organisms. Downstream, the stream channel is unnaturally wide and deep, due to erosion associated with the culvert.

2.1.3 North Home Ranch Crossing

The culvert at the intersection of Estero Road and North Home Ranch Creek is a 36-inch diameter, 21-foot long corrugated metal pipe. North Home Ranch Creek is shallow and at nearly the same grade as its floodplain. Although the culvert itself is in fair condition, its small size and lack of depth prevents it from accommodating even moderate flows. The culvert and road are overtopped by 2-year and larger discharge events. Unlike the Mount Vision and Estero Crossings, this crossing is not open to the general public, but is used only for administrative purposes, cattle ranching activities and by the residents at Home Ranch. The North Home Ranch Crossing site has known cultural resources, which consist of historic homestead foundations adjacent to the Project Area.

2.1.4 Home Ranch Crossing

This culvert, located at the point where Estero Road passes over Home Ranch Creek, is located in an active ranch complex on a highly modified reach of the creek. The 57-inch high by 83-inch wide corrugated metal arch culvert is 30 feet long. The arch is protected on each side of the road by grouted rock riprap. The culvert structure is in fair condition; however, it lacks the capacity to accommodate even 10-year flow events. Deposition of sand and cobble on the culvert floor has decreased the effective height of the structure by 12-24 inches. In addition, the depositional reach of Home Ranch Creek at this stream segment contributes to the culvert's inability to convey an adequate flow; storm waters in the channel easily overtop the shallow culvert. The culvert's low capacity contributes to frequent flooding of the adjacent Home Ranch structures. As with the North Home Ranch Crossing, this crossing is only accessible to ranch residents and PRNS staff.

2.1.5 Upper Laguna Crossing

The culvert at the entrance to the Laguna Trailhead parking lot provides conveyance for Laguna Creek. It consists of a 72-inch diameter, 18-foot long reinforced concrete pipe with a 120-inch tall concrete sack headwalls and a 1-foot high asphalt apron at the inlet. Although the pipe itself is in good condition, the associated headwalls are damaged and failing. The culvert has adequate conveyance capacity; it is capable of accommodating a 100-year flood or greater. Conditions downstream of the culvert vary from year to year and may result in 12-24 inch drops that can impede movement of aquatic organisms. Downstream of the culvert, on the stream banks, is a set of historic bridge piers.

2.1.6 Lower Laguna Crossing

The culvert at the intersection of Coast Trail and Laguna Creek is a 72-inch diameter, 17-foot long reinforced concrete pipe. The pipe is in good condition, with protective riprap on the stream banks above and below the structure, and with a concrete headwall at its inlet. The stream channel, both upstream and downstream of the crossing, is aggraded to within 2 feet of the top of the culvert. Under high flow conditions, water is stacked upstream and scours through the culvert at high velocities, creating a depositional fan downstream. The culvert is part of a 300-foot road across the Laguna Creek floodplain, and flow is controlled through this culvert.

Table 2.1 Summary of Existing Culvert Facilities within the Project Area

Site	Culvert Type and Size	Conveyance Capacity	Structural Condition	Additional Information
Mount Vision	48" corrugated metal pipe, 29' long	10-year flow event	Poor	Severe downstream channel erosion, Large outlet drop (60 inches)

Estero	83"h by 53"w corrugated metal arch, 24' long	100-year flow event	Poor	Downstream channel erosion, Large outlet drop (36 inches)
North Home Ranch	36-inch corrugated metal pipe, 21' long	2-year flow event	Fair	Culturally resources adjacent to project area
Home Ranch	83"h by 53"w corrugated metal arch, 30' long	10-year flow event	Fair	Highly modified reach of Home Ranch Creek
Upper Laguna	72" reinforced concrete pipe, 18' long, with concrete sack headwalls	100-year flow event	Good	Failing headwalls, cultural resources in project area
Lower Laguna	72" reinforced concrete pipe, 17' long, with concrete headwalls and asphalt apron	2-year flow event	Good	

2.2 Alternative Formulation Process

This section describes how PRNS managers develop the alternatives proposed in this document. NPS managers are primarily directed by the NPS Organic Act and federal natural and cultural resource protection laws, as described in Section 2.2.1. The range of project alternatives is limited by the site design considerations, including fish passage, described in Section 2.2.2. The alternatives for replacing failing culverts and restoring habitat for aquatic organisms were formulated with the assistance of technical design options developed by Jones & Stokes, Inc. and Northwest Hydraulic Consultants. The results of pre-design investigations were evaluated as part of the Choosing by Advantages, cost/benefit Value Analysis process, described in Section 2.2.3.

2.2.1 Project Guiding Laws, Regulations, Policies, and Plans

The following is a brief description of the primary laws, regulations and plans, which guide PRNS managers during alternative formulation. For an exhaustive list of laws and policies consulted during the development of this assessment, consult Section 1.8.

- National Park Service Organic Act (PL 64-235, 16 USC §1 et seq., 1916)
- National Environmental Policy Act (NEPA, 1970)
- Federal and State Endangered Species Acts
- Clean Water Act (Federal Water Pollution Control Act, 1977)
- Antiquities Act (1906), the Archeological Resources Protection Act (1979)
- Executive Order 11988: Floodplain Management
- Executive Order 11990: Protection of Wetlands

2.2.2 Site Design Considerations

The environmental resources and timeline for this project are driven by the presence of federally listed steelhead, and critical habitat for coho salmon. In order to insure that park infrastructure within these watersheds do not impede watershed function and prevent fish access, the following restoration design

criteria were established for development of site alternatives. This project intends to meet fish passage criteria using the Active Channel design method. The Active Channel design criteria state that the road crossing will pass the 100-year flood discharge, with a width equal to 1.5 times the active channel width. It is assumed that meeting the Active Channel criteria will also meet velocity constraints of salmonids at various life stages. Information presented in this section is adapted from the Culvert Replacement Conceptual Design Report (NHC 2002).

2.2.2.1 Structural Design and Flood Capacity

The National Park Service typically designs stream crossings for passage of a 50-year event. The crossings within this project are on streams known to support federally threatened steelhead trout. Guidelines for salmonid passage published by the National Marine Fisheries Service state that crossings on streams supporting this species should pass the 100-year peak flow without structural damage (NOAA Fisheries 2001). This design criterion reduces the risk of channel degradation or avulsion, and the risk of overall crossing failure during its structural lifespan.

The passage of the 100-year event was used as a target for the stream crossings in this Project, and alternatives were considered to meet this criterion. However, at some sites, the stream and site morphology is such that there is no feasible alternative meeting this criterion. In these cases, the document identifies geomorphic limitations and uses secondary criteria to identify alternative crossing designs at their maximum practicable size.

2.2.2.2 Fish Passage Criteria

The primary reference used to guide selection of potential passage improvements for fish and other species is a set of state and federal guidelines (NOAA Fisheries 2001;CDFG 2002). Table 2.2 summarizes the 3 design methods provided in the guidelines.

Table 2.2. Culvert Design Guidelines (NMFS, 2001)

Design Method	General Features	Specific Features	Limitations
Active Channel	• Natural channel maintained within culvert • Hydraulic calculations (i.e. flow depth, velocity) not necessary	• Width = 1.5 Active Channel Width • Slope, culvert placed level Embedment limits: • minimum 20% of outlet height • maximum 40% of inlet height	Not suitable for channel slopes greater than 3% or culverts longer than 100 ft
Stream Simulation	• Natural channel maintained within culvert • Requires hydraulic/geomorphic information	• Width ≥ Bankfull Width (min. 6 ft) • Slope = Reach Slope (max. 6%) Embedment limits: • minimum 30% of culvert height • maximum of 50% of culvert height • Footings placed below scour depth	Minimum culvert width = 6 ft Maximum slope = 6%
Hydraulic	• Combines standard culvert hydraulic design with fish swimming capabilities	• Width = Calculated • Slope = Reach Slope, if not embedded Embedment limits: • Where possible, minimum of 20% of culvert height below tailwater control or 1 ft minimum	Minimum culvert width = 3 ft If no embedment, maximum slope = 0.5% Hydraulic drop at outlet not to exceed 1 ft

In the hydraulic design assessment method, velocity within the culvert barrel is among the most important criteria with respect to fish passage. The anticipated velocities should not exceed the recommended values

or accelerated flows will act as barrier to upstream migrating fish. For adult salmon, and culverts less than 60 feet in length, the maximum allowable velocity within the culvert barrel is 6 feet per second (fps). This condition is for the high fish passage design flows, calculated as 50% of the 2-year peak discharge (NOAA Fisheries 2001). Low flow velocities and flow depths must also be considered in situations where the recommended design will not have a natural bottom. It is assumed in this study that the potential improvements at each of the 6 culvert crossing sites will include a natural bed or embedded culvert. Under these conditions, the guidelines assume that low flow hydraulic characteristics will not impede fish passage.

2.2.3 Facility Design Process – Alternatives Development Process

Alternatives for the proposed action were developed and screened through the NPS value analysis (VA) process, which is a systematic method of weighing the anticipated benefits and risks of various possible solutions to a defined problem. The VA process consists of 4 phases.

1. **Pre-design Phase:** Identify project objectives and formulate potential approaches.
2. **Creativity Phase:** Conduct free-ranging evaluation of potential outcomes associated with approaches identified in pre-design phase.
3. **Evaluation Phase:** Systematically evaluate and screen alternatives to narrow the field and, ultimately, identify a preferred alternative for implementation.
4. **Implementation Phase:** Modify the preferred alternative to fine-tune it based on results of evaluation phase and environmental review; implement.

During the pre-design phase, NPS and the consultant team completed studies to identify and evaluate the feasibility of different restoration approaches at the 3selected sites. Early work included analyses of culvert condition, stream channel profile, site surveys, hydraulic modeling, flood capacity and flow velocity calculations (Jones & Stokes and NHC 2002).

Once substantial progress had been made in the pre-design phase, the VA team for the proposed action convened. The meeting, which took place at Point Reyes National Seashore on June 3–5, 2003, focused on (1) further evaluating various options for construction and materials that had been identified in the pre-design phase, and (2) selecting an alternative for further refinement during project design. The following sections provide additional detail on the evaluation process used during this meeting, which comprised the creativity and evaluation phases of the VA process (National Park Service 2003).

2.2.3.1 Creativity Phase

The creativity phase of the project VA meeting involved “”brainstorming” to address the risks associated with various approaches to coastal stream restoration, and then reviewed the function and purpose of the system. The team then reviewed the alternatives developed in the pre-design phase and identified other possible approaches.

The highest risks noted in the analysis are summarized in Table 2.3 below.

2.2.3.2 Evaluation Phase

During the evaluation phase, the VA team conducted a systematic analysis of alternatives considered and/or developed in the creativity and pre-design phases, in order to eliminate those that were not expected to be feasible or were judged unsuitable for other reasons. Principal guidance for the evaluation came from the project objective of repairing or removing facilities that limit or impair the natural hydrologic function in the Drake’s Estero watershed, in order to allow reintroduction and enhancement of threatened aquatic populations, including steelhead and Coho salmon. Additional guidance came from the following resource protection priorities, which are based on the NPS mission and strategic goals.

- **Factor 1:** Prevent loss of cultural resources.
- **Factor 2:** Maintain and improve condition of natural resources.
- **Factor 3:** Provide visitor services, educational opportunities, and recreational opportunities.
- **Factor 4:** Protect the health, safety, and welfare of the public.
- **Factor 5:** Improve operational efficiency, sustainability, and constructability.
- **Factor 6:** Protect employee health, safety, and welfare.
- **Factor 7:** Provide cost-effective, environmentally responsible, and otherwise beneficial development of the NPS.

Because of the identified need to improve passage for native anadromous fishes, evaluation criteria included not only water quality and hydraulic function, but also factors related to fish passage, including flow velocities through constrictions; low-flow velocities and minimum flow depths; and the height of proposed drops. Table 2.3 summarizes the evaluation criteria used in the VA process. Additional information is provided in the VA report prepared for the project (National Park Service 2003).

Table 2.3. VA Evaluation Criteria for Project Alternatives

Evaluation Focus	Evaluation Criteria
Floodplains	Preserve floodplain values.
	Minimize potentially hazardous conditions associated with flooding.
	Comply with the NPS Organic Act and all other federal laws and Executive Orders related to the management of activities in flood-prone areas, including Executive Order 11988 (Floodplain Management), NEPA, and applicable provisions of the Clean Water Act and the Rivers and Harbors Appropriation Act of 1899.
Watershed and stream processes	Manage watersheds as complete hydrologic systems.
	Minimize human disturbance to the natural upland processes that deliver water, sediment, and woody debris to streams, including runoff, erosion, and disturbance to vegetation and soil caused by fire, insects, meteorological events, and mass movement.
	Manage streams to protect stream processes that create habitat features such as floodplains, riparian systems, woody debris accumulations, terraces, gravel bars, riffles, and pools.
	Achieve protection of watershed and stream features primarily by avoiding impacts to watershed and riparian vegetation and by allowing natural fluvial processes to proceed unimpeded.
	When conflicts between infrastructure (such as bridges and pipeline crossings) and stream processes are unavoidable, consider relocating or redesigning facilities, rather than manipulating streams.
	Where stream manipulation is unavoidable, use techniques that are visually non-obtrusive and that protect natural processes to the greatest extent practicable.

The geomorphic criteria were based on NPS Management Policies requiring that structures and facilities be designed consistent with the intent of the National Flood Insurance Program's standards and criteria (44 CFR Part 60).

A key portion of the evaluation phase for the project is documentation of the evaluation process and its outcome. This information is presented in the VA report for the proposed action (NPS 2003).

2.3 Alternative A: No Action

Alternative A describes future conditions of the project sites if existing routine maintenance and management were to continue. No treatment actions are proposed under Alternative A.

Under this alternative, the 6 project areas would continue to require on-going annual maintenance. During winter storms, if culverts became clogged with debris, PRNS or ranch staff would perform minor cleaning to restore maximum conveyance capacity. In the likely event of a culvert failure, PRNS staff would be required to conduct an emergency replacement of the damaged facility with a culvert structure similar to the current structure. Each of these actions would be conducted under existing NPS Categorical Exclusions.

2.4 Elements Common to Both Action Alternatives

The 2 action alternatives – Alternatives B and C – have many resource protection measures and design elements in common. These are described below in this section.

2.4.1 Best Management Practices

In order to protect natural and cultural resources, PRNS managers have defined a set of Best Management Practices for use during construction projects on Seashore lands. These include measures to minimize erosion and sediment mobilization, revegetation measures, explicit plans to prevent and respond to chemical spills, actions to protect cultural resources, measures to minimize disruption to recreation in the Seashore, and practices to protect plant and animal life in the project area. These BMPs would be employed by the NPS or contractor staff engaged in construction activities described in the alternatives below. Construction activities would be monitored by the project manager to assure compliance with BMPs. A detailed description of these measures is found in Appendix B of this document.

2.4.2 Construction Timelines

Potential impacts to natural and cultural resources, and to recreational opportunities and human safety as a result of Alternatives A, B, and C are assessed in this chapter. Impacts will vary at the 6 sites dependent on treatment and duration of construction activities. Table 2.4, below provides a summary of the maximum expected construction window under each alternative. It is anticipated these construction activities will take place during the construction period between August 1 and October 31, 2005.

Table 2.4: Expected maximum duration of construction activities at each site

	Alternative A	Alternative B	Alternative C
Mount Vision	No Action	3 weeks	Same as B
Estero	No Action	3 weeks	Same as B
North Home Ranch	No Action	2 weeks	Same as B
Home Ranch	No Action	2 weeks	Same as B
Upper Laguna	No Action	3 weeks	2 weeks
Lower Laguna	No Action	3 weeks	2 weeks

Cumulative effects may occur as a result of concurrent construction activities associated with the Coastal Watershed– Geomorphic Restoration Project within the Drakes Estero watershed. This project will require treatment at 3 sites within the watershed. Construction activities will last for 1 month at each site. It is also anticipated that construction will take place in 2005.

2.4.3 Streamflow bypass installation

At each site and before construction begins, a bypass would be installed to convey streamflow around the construction area. Water pumped from the channel would be conveyed via flexible high-density polyethylene (HDPE) pipe to a temporary outfall located downstream of the project area. If pumping is necessary, it will be equipped with approved screening to prevent it from drawing in wildlife. This bypass would be maintained throughout the construction window, and discontinued when construction was

complete. Because the construction window is at the lowest flow period of time, it is expected that bypass rates will be less than 1 cubic foot per second (448 gallons per minute).

Aquatic species within the bypass section would be captured and moved to habitat either upstream or downstream depending on local conditions. Seining and electrofishing will be conducted by NPS staff to capture and move native aquatic species, including salmonids. The construction area would be isolated from the aquatic system with screening upstream and downstream of the site. Each morning, prior to construction, a qualified biologist would survey the site for amphibians or other species and remove them to areas adjacent to, but outside the construction area.

2.4.4 Revegetation and Erosion Control

As part of site closeout, revegetation and erosion control activities would be completed in disturbed areas. As part of the project initiation, site topsoil and vegetation would be stockpiled. Final grading should include the use of this stockpiled topsoil to support natural revegetation at each site. Topsoiling would provide a natural seedbank and is expected to foster rapid reestablishment of vegetation.

Erosion control measures would be installed as needed on the slopes and at the toe of the slope to prevent excessive sediment runoff until vegetation reestablishes. If necessary, the area could also be seeded with a sterile, fast-growing erosion control mix that would germinate quickly to provide added stabilization, but would not reproduce and thus would not impede establishment of the desired native species. Topsoiled and/or seeded areas would be monitored following standard NPS protocols to ensure that vegetation establishes successfully.

2.4.5 Mount Vision Crossing

Both Alternative B and Alternative C propose the same action for the Mount Vision Crossing. The differences in engineered designs would require the same project footprint and implementation impacts. Depending on geotechnical investigation results, the existing undersized and failing culvert would be removed and replaced with a bottomless pre-cast concrete arch, multi-plate arch, or box culvert. The 16-foot bottomless arch structure would span the entire channel, with its footings constructed on the margins of the East Schooner Creek channel. The 12-foot wide by 8-foot high box culvert would be placed in the bed of the channel, with the bottom of the culvert 2 feet below existing grade.

Either structure would allow for conveyance of 100-year flows, and would be designed to allow for natural gravel and cobble creek bed within the crossing. The addition of headwalls to this crossing will afford a wider, more stable road shoulder and improved traffic safety. The proposed structure would comply with NOAA Fisheries and CDFG guidelines for fish passage. It would allow fish access to an additional ½ mile of suitable stream habitat above the crossing.

Because of the current streambed's eroded grade, the design requires the placement of boulder cross-vane structures to step-down the steep channel, to minimize incision downstream, and to prevent development of upstream headcutting. In addition, in order to protect the integrity of the road crossing, a cement retaining wall or sill would be installed at the downstream end to prevent undermining of the foundation (Figures 2.1 and 2.2). The cement sill would ensure structural stability, and would be integrated with the boulder cross-vane design. Installation of the cement retaining wall and approximately 7 boulder weirs would require excavation in the stream bed at periodic spatial intervals for approximately 75 feet upstream and 150 feet downstream of the road crossing.

Construction would occur at this site over a 2-3 week period of time. A water bypass would be installed to convey clean water around the construction area and into the stream channel below for the duration of the activities. Installation would require a temporary road closure at this site with limited access to the park residences and FAA transponder station through the Vision Fire Road. Construction equipment would include an excavator and a crane for placement of the boulder weirs and the pre-cast cement structural segments.

2.4.6 Estero Crossing

The Estero Road Crossing would also be subject to an identical treatment under either Alternative B or Alternative C. The differences in engineered designs would require the same project footprint and implementation impacts. Depending on geotechnical investigation results, the existing undersized and failing culvert would be removed and replaced with a bottomless pre-cast concrete arch, multi-plate arch or box culvert (Figure 2.3 and 2.4). The 16-foot bottomless arch structure would span the entire channel, with its footings constructed on the margins of the East Schooner Creek channel. The 12-foot wide by 8-foot high box culvert would be placed in the bed of the channel, with the bottom of the culvert 2 feet below existing grade.

Either structure would allow for conveyance of 100-year flows, and would be designed to allow for natural gravel and cobble creek bed within the crossing. The addition of headwalls to this crossing will afford a wider, more stable road shoulder and improve traffic safety. The proposed structure would comply with NOAA Fisheries and CDFG guidelines for fish passage facilitating access to approximately 2 miles of East Schooner Creek.

As with the proposal for the Mount Vision crossing, in-channel boulder weirs would be installed in the creek bed to step-down the steep channel, minimize further incision downstream, and prevent headcutting upstream. Also, a cement sill would be installed at the downstream end of the structure to prevent scour that could destabilize the foundation. Installation of the cement sill and approximately 5 boulder weirs would require excavation of the creek bed at widely spaced intervals for 75 feet upstream and 100 feet downstream of the crossing structure.

As with the proposal for Mount Vision Road, construction would occur at this site over a 2-3 week period of time. A water bypass would be installed to convey clean water around the construction area and into the stream channel below for the duration of the activities. Construction of the upgraded crossing at this site would require a temporary bypass that would be maintained within the project footprint to accommodate restricted traffic only.

2.4.7 North Home Crossing

As with the Mount Vision and Estero crossings, the proposed design for culvert replacement is identical for both action alternatives.

The existing undersized culvert would be replaced with a pre-cast 8-foot wide, 4-foot high reinforced concrete box culvert (Figure 2.5 and 2.6). The box culvert would be set into the creek bed 12 inches below natural grade to allow for a natural gravel/cobble bottom. Boulders and cobbles would be moved into the culvert to increase the roughness of the streambed material, to create diverse habitat opportunities for aquatic organisms, and to encourage slower, deeper flows through the structure for fish passage. The buried culvert bottom will provide stability to the crossing. The proposed structure would comply with NOAA and CDFG guidelines for fish passage.

This route is accessed by large transport equipment for the ongoing cattle operations in the area. The ends of the culvert are bent as the culvert is on a tight corner in the road to Home Ranch. Installation of the box culvert would require excavation of a shallow trench in the streambed, placement of culvert segments, and grouting of joints between segments. This type of structure requires only a minimal distance between the top of the culvert and the road surface, allowing for maximum conveyance capacity within the available space. The box culvert is selected to replace the metal culvert to increase design life and reduce long-term maintenance and replacement costs. Headwalls would be installed to the road grade and no guardrails would be included to accommodate large tractor-trailer access to the ranch site.

Construction would occur at this site over a 2-3 week period of time. A water bypass would be installed to convey clean water around the construction area and into the stream channel below for the duration of the

activities. Because the site is only accessible to authorized vehicles, a minimum amount of traffic will be affected. The site can accommodate a temporary bypass for those vehicles.

2.4.8 Home Ranch Crossing

At the Home Ranch crossing the proposed treatment is identical for both action alternatives.

The existing undersized crossing structure would be replaced with a pre-cast reinforced concrete 3-sided bridge. The 3-sided bridge would span 16 feet across the channel and provide a minimum 4-foot clearance for stream flows (Figure 2.7 and 2.8). Due to the existing channel configuration, the proposed structure would accommodate no more than a 10-year peak discharge. The Home Ranch Crossing site is located immediately adjacent to the historic Home Ranch facility. Because houses and barns associated with Home Ranch are located within a few feet of the crossing, options at this site are severely restricted. This site is also lower down in the watershed, in what historically would have been a wide valley floodplain. The bed of the channel is aggrading, resulting in limited flow conveyance through the site. The proposed bridge maximizes conveyance through the site without raising the road level. The proposed treatment, while it does not solve flood issues, maximizes the conveyance through the site, and will not further aggravate existing flood conditions.

To reduce flooding, the treatment at the Home Ranch Crossing would also include floodplain modification upstream of the proposed culvert replacement and adjacent to the historic ranch house. Excavation adjacent to the channel would create a floodwater bench at the estimated bankfull level, expanding the channel conveyance capacity through this bottleneck, reducing the potential of overbank flooding that would effect the historic ranch house. Excavated material would be used to create a low-profile (approximately 1-foot) setback levee between the creek and the ranch house, which sits immediately adjacent to the stream bank. Approximately 100 cubic yards of stream bank material would be moved. This channel modification would relieve flow constrictions associated with the narrowest portion of this reach of Home Ranch Creek, which is not at the crossing, but just upstream of the culvert. The overall effect of the combined actions of channel modification and culvert replacement would be to allow this reach of Home Ranch Creek to accommodate a 10-year flow event.

NOAA Fisheries and CDFG fish passage guidelines call for a minimum active channel width of 18 feet for this site. While the proposed structure would only allow for a 16-foot channel span, it is twice the current active channel width. Existing historic buildings at the site and watershed conditions further constrain treatment options at this site. This route is used by large transport equipment for the ongoing cattle operations in the area. Headwalls would be installed to the road grade and no guardrails would be included to accommodate large tractor-trailer access across the structure and within the ranch area.

Construction would occur at this site over a 2-3 week period of time. A water bypass would be installed to convey clean water around the construction area and into the stream channel below for the duration of the activities. Installation of the three-sided bridge would require a temporary road closure at this site affecting ranch residents only. Construction equipment would include an excavator and a crane for placement of the structure.

2.5 Alternative B: Restore Fish Passage and Minimize Future Maintenance Needs

Alternative B includes treatments for the Upper and Lower Laguna Crossings that improve stream conditions for aquatic species. This alternative would also include the treatments at Mt. Vision Road at East Schooner Creek, Estero Road at East Schooner Creek, Estero Road at North Home Ranch Creek, and Estero Road at Home Ranch Creek as described in Section 2.4. This proposed alternative would entail installation of prefabricated steel bridges at each site in order to maximize the structural integrity of each crossing structure, and to minimize future costs and resource impacts associated with the repair and replacement of crossing structures.

2.5.1 Upper Laguna Crossing

Under this Alternative a 40-foot long by 18-foot wide bridge would be installed to replace the existing reinforced concrete pipe culvert (Figure 2.9 and 2.10). Depending on the specifications of the bridge, the new structure would allow for a 7.5-8.0 feet clearance between the channel bottom and the span. This structure would comply fully with NOAA and CDFG guidelines for fish passage, and would accommodate 100-year flow events

At this site, the channel transitions from a narrow, deeply incised system upstream of the culvert, to a wide, laterally meandering channel downstream of the culvert. Installation of the bridge would require construction of concrete foundations set into the existing valley terrace. The excavated slopes would need to be heavily armored to protect the upstream reach from the excessive channel erosion associated with widened downstream conditions. Depending on soil conditions at the site, to be determined through a geotechnical investigation, the abutments would consist of a spread footing or a pile-supported design. The prefabricated bridge would be delivered to the site in 2 pieces (9x40 foot halves). Due to steep channel banks in this reach of Laguna Creek, Alternative B would require bank stabilization with riprap for 20 feet upstream and downstream of the crossing, with bank slopes between 1:1 and 1.5:1. In order to minimize unnaturally accelerated erosion associated with this crossing, this alternative would require excavation and installation of two-2 grade-control structures in the channel bed.

Construction would occur at this site over a 2-3 week period of time. A water bypass would be installed to convey clean water around the construction area and into the downstream channel for the duration of the construction. Installation would require a temporary closure of this crossing, resulting in restriction of pedestrian access to the park residences (approximately 100-yard distance). Construction equipment would include an excavator and a crane for placement of the prefabricated bridge.

2.5.2 Lower Laguna Crossing

Alternative B proposes installation of a 30-foot long by 10-foot wide steel bridge to replace the undersized culvert at the Lower Laguna Crossing (Figure 2.11 and 2.12). This action would be very similar to the proposed upgrade for the Upper Laguna Crossing under Alternative B. The prefabricated bridge would provide a 4-foot to 5-foot clearance for conveyance of stream flow below the road crossing, and accommodate 100-year flow events. At this site, the bridge could be installed at a higher elevation relative to the road. This structure meets NOAA and CDFG fish passage guidelines.

As with the proposed structure at Upper Laguna Crossing under Alternative B, installation of a bridge at this site would require construction of 2 concrete or riprap abutments on the stream banks. Re-grading of the road surface immediately on either side of the crossing might be necessary prior to bridge installation. Installation of this bridge would not require construction of in-channel grade control structures.

Construction would occur at this site over a 2-3 week period of time. A water bypass would be installed to convey clean water around the construction area and into the stream channel below for the duration of the activities. As with the Upper Laguna crossing treatment proposed under this alternative, installation would require a temporary closure of this crossing. At this site, however, road access is limited to NPS vehicles and foot, bicycle, and horse traffic. Construction equipment would include an excavator and a crane for placement of the prefabricated bridge.

2.6 Alternative C: Restore Fish Passage and Maximize Long-Term Management Flexibility (Preferred Alternative)

Like Alternative B, Alternative C offers treatments for the Upper and Lower Laguna Crossings that improve stream conditions for aquatic organisms. This alternative would also include the treatments at Mt. Vision Road at East Schooner Creek, Estero Road at East Schooner Creek, Estero Road at North Home Ranch Creek, and Estero Road at Home Ranch Creek as described in Section 2.4. However, this alternative maximizes long-term management flexibility while still enhancing channel connectivity and fish passage.

The proposed design would entail limited treatment activities at each site to meet project objectives while allowing flexibility to alter infrastructure configurations to meet future management goals.

2.6.1 Upper Laguna Crossing

Under this Alternative existing structures would be stabilized to minimize the chance of failure and reduce in-culvert flow velocities. The concrete sack headwall would be repaired and the existing reinforced concrete culvert that can accommodate a 100-year flow event, would be retained. In order to improve hydrologic connectivity, reduce velocities through the culvert, and relieve pressure on documented historic bridge abutments, 3 boulder grade-control structures would be installed in the streambed downstream of the crossing. These structures would be keyed into the stream banks, and incorporate a 12-inch maximum water surface drop between structures. The most upstream boulder weir would be elevated above the current channel bed to create backwater pooling into the culvert during low flow conditions and allow fish passage through the structure. This above-grade weir would also dissipate stream energy during high flow events.

Construction would occur at this site over a 2-week period of time. A water bypass would be installed to convey clean water around the construction area and into the stream channel below for the duration of the activities. Installation of the boulder weirs would require excavation into the streambed at 3 sites downstream of the crossing. Only minimal access closures would be required for this upgrade of the Upper Laguna Crossing.

2.6.2 Lower Laguna Crossing

Alternative C proposes installation of an 11.6-foot wide, 7.6-foot high, corrugated metal pipe arch or 12x8 concrete box culvert to replace the existing undersized structure (See Figure 2.11 and 2.12). The culvert would be set into the creek bed 12 inches below natural grade to allow development of a cobble bottom. The buried culvert bottom would minimize the need to excavate the creek bed and set the culvert. The road crossing is located in a depositional reach of Laguna Creek, near the Laguna Pond. Although the structure would not accommodate flood flows greater than those of a 10-year event, the design meets minimum NOAA and CDFG velocity and channel width criteria for fish passage. This treatment would double the cross-sectional area and the channel widths provided with the current culvert.

Construction would occur at this site over a 2-week period of time. A water bypass would be installed to convey clean water around the construction area and into the stream channel below for the duration of the construction. Installation of the culvert would require excavation of a shallow trench in the streambed, placement of culvert segments with a crane, and grouting of joints between segments. Minor grading of the roadway immediately on either side of the crossing would be required. Only minimal access closures would be required for installation of this facility.

Table 2.5 Summary of Proposed Culvert Facilities under Alternatives A, B, and C

Site	Alternative A: No Action	Alternative B	Alternative C
Mount Vision	4-foot diameter corrugated metal pipe	16' x 5' pre-cast concrete or multi-plate bottomless arch or 12x8 concrete box culvert	Identical to Alternative B
	Capacity: *10-year flow event, 13 square feet*	*Capacity:* *100-year flow event, 71 square feet (arch)* *72 square feet (box)*	

Estero	83"h by 53"w corrugated metal arch	16' x 5' pre-cast concrete or multi-plate, or 12x8 concrete box culvert	Identical to Alternative B
	Capacity: *<100-year flow event, 28 square feet*	*Capacity:* *100-year flow event, 71 square feet (arch)* *72 square feet (box)*	
North Home Ranch	3-foot diameter corrugated metal pipe	8' wide x 4' high reinforced concrete box culvert	Identical to Alternative B
	Capacity: *2-year flow event, 7 square feet*	*Capacity:* *100-year flow event, 24 square feet*	
Home Ranch	83"h by 53"w corrugated metal arch	16' x 6' cement 3-sided bridge	Identical to Alternative B
	Capacity: *10-year flow event, 30 square feet*	*Capacity:* *100-year flow event, 64 square feet*	
Upper Laguna	5-foot diameter reinforced concrete pipe	40' by 18'w prefabricated steel bridge	72" diameter reinforced concrete pipe with downstream channel modification to facilitate hydrologic connectivity
	Capacity: *100-year flow event, 28 square feet*	*Capacity:* *100-year flow event, 75 square feet*	*Capacity:* *100-year flow event, 28 square feet*
Lower Laguna	6-foot diameter reinforced concrete pipe	30'l by 10'w prefabricated steel bridge	11.6-foot wide, 7.6-foot high corrugated metal pipe arch, or 12-foot by 8-foot concrete box culvert
	Capacity: *2-year flow event, 28 square feet*	*Capacity:* *100-year flow event, 100 square feet*	*Capacity: 10-year flow event, 35 square feet (metal arch)* *72 square feet (cement box)*

2.7 Alternatives Considered but Dismissed

During formulation of the 3 alternatives described above, additional alternatives were considered at each site but dismissed. These alternatives were dismissed because they either did not meet the principal project goal of approaching or complying with National Marine Fisheries Service (NOAA-Fisheries) and California Department of Fish and Game fish passage guidelines, or the additional design and cost did not result in additional resource benefit. While other engineered options for the 6 crossings were available, these caused similar or more severe resource impacts, and did not adequately further the project's principal goal.

This section presents the alternatives that were considered in the Value Analysis process but were dismissed from detailed analysis because of one or more fatal flaws. Table 2.6 briefly describes each alternative eliminated and summarizes the reasons for elimination.

Table 2.6. Summary of Approaches Eliminated from Further Consideration

Site	Approach	Advantages	Reasons Eliminated from Further Consideration
Mt. Vision Road at East Schooner Creek	Replacing existing culvert with bridge structure.	Could meet all project objectives.	Would require additional armoring to maintain bed profile through the project site. The work area is limited pr would impede on the county road right-of-way. The design for the channel size and capacity are excessive.
Estero Road at East Schooner Creek	Replacing existing culvert with bridge structure.	Could meet all project objectives.	Would require additional armoring to maintain bed profile through the project site. The work area is limited pr would impede on the county road right-of-way. The design for the channel size and capacity are excessive.
Estero Road at North Home Ranch Creek	Replace existing metal culvert with 7'x5' arched metal culvert	Increase flow conveyance	Shorter design life than box culvert (less durable). More cover required for metal culvert thereby increasing road profile across the entire valley. Maintains a limited road prism for truck access.
Estero Road at Home Ranch Creek	Replace existing metal culvert with 12'x6' cement box culvert	Increases flow conveyance	Higher potential for flooding by affording less flow conveyance than 16x6 bridge structure.
Laguna Trailhead at Laguna Creek (Upper Laguna)	Replace existing cement culvert with 8'x10' concrete box culvert	Would maintain streamflow without impacts on existing slopes.	Essentially replaces function and conditions of the current structure (which is stable and passes 100-year flow). Grade control would still be required.
Coast Trail at Laguna Creek (Lower Laguna)	Add additional culverts through road bed	Accommodate higher flood flows without destabilizing road	Floodplain configuration is such that these culverts would not be used in most flow conditions, and would not enhance existing floodplain function or condition.

2.8 Preferred Alternative (Alternative C)

This EA compares the anticipated success of each alternative in meeting the objectives identified for the proposed action. Table 2.7 presents an overview of the impacts associated with each of the 3 alternatives. The *preferred alternative* is the alternative identified through the Value Analysis and which best meets long-term management objectives at the Seashore. Based on the environmental analysis in this EA, the NPS has elected Alternative C as its preferred alternative to meet the purpose and need identified for this project. The components of the preferred alternative are summarized below. They include the following.

List of site treatments for Preferred Alternative

- **Mt. Vision Road at East Schooner Creek-** Install a cement arch culvert with associated grade control to facilitate flood flow conveyance and fish passage for adult and juvenile salmonids. This structure will provide improved health and safety and minimize long-term operations and maintenance requirements.

- **Estero Road at East Schooner Creek -** Install a cement arch culvert with associated grade control to facilitate flood flow conveyance and fish passage for adult and juvenile salmonids. This structure will provide improved health and safety and minimize long-term operations and maintenance requirements.

- **Estero Road at North Home Ranch Creek –** Install a cement box culvert to increase flood flow conveyance and potential fish passage through the site. This structure will provide improved health and safety and minimize long-term operations and maintenance requirements.

- **Estero Road at Home Ranch Creek –** Install a 3-sided cement bridge to maximize flow conveyance through the historic Home Ranch complex. Additional regrading of areas adjacent to the Home Ranch house would create a bankfull bench and low setback berm to reduce flooding potential.

- **Upper Laguna –** Install grade control downstream of the existing cement culvert and repair the existing headwall to meet fish passage criteria. This alternative reduces flow velocities through the culvert and maintains existing stability with this altered channel reach.

- **Lower Laguna –** Install an arch metal culvert to increase flow conveyance through the site but not reduce long-term management flexibility with regard to wilderness corridors and access.

2.9 Identification of Environmentally Preferred Alternative

The *environmentally preferred alternative* is the alternative that would best 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 while best protecting, preserving, and enhancing historic, cultural, and natural resources.

The actions identified as the NPS preferred alternative are the same as those identified as the environmentally preferred alternative at 5 of the 6 project sites.

At the Lower Laguna site, environmentally preferred alternative is the bridge crossing. Explanation of why the preferred alternative (metal arch culvert, low infrastructure investment) is preferred over the (bridge crossing) is included below.

The Lower Laguna site is part of a 300-foot road section crossing the valley perpendicular to flow gradients. The floodplain processes in this area are highly dynamic and aggrading rapidly. While a bridge would create more space for the channel and floodplain process, removal of the entire road section and fill would be best for the floodplain and system. The preferred alternative limits the investment in infrastructure at this site and would not preclude future consideration of alternatives, including removal and rerouting of the road, or accessing Coast Camp via other available routes.

List of site treatments for Environmentally Preferred Alternative

- **Mt. Vision Road at East Schooner Creek-** Install a cement arch culvert with associated grade control to facilitate flood flow conveyance and fish passage for adult and juvenile salmonids. This structure will provide improved health and safety and minimize long-term operations and maintenance requirements.

- **Estero Road at East Schooner Creek –** Install a cement arch culvert with associated grade control to facilitate flood flow conveyance and fish passage for adult and juvenile salmonids. This structure will provide improved health and safety and minimize long-term operations and maintenance requirements.

- **Estero Road at North Home Ranch Creek –** Install a cement box culvert to increase flood flow conveyance and potential fish passage through the site. This structure will provide improved health and safety and minimize long-term operations and maintenance requirements.

- **Estero Road at Home Ranch Creek –** Install a 3-sided cement bridge to maximize flow conveyance through the historic Home Ranch complex. Additional regrading of areas adjacent to the Home Ranch house would create a bankfull bench and low setback berm to reduce flooding potential.

- **Upper Laguna –** Install grade control downstream of the existing cement culvert and repair the existing headwall to meet fish passage criteria. This alternative reduces flow velocities through the culvert and maintains existing stability with this altered channel reach.

- **Lower Laguna –** Install a bridge to increase flow conveyance. This investment in infrastructure, however would reduce longer-term management flexibility with regard to wilderness corridors and access.

Table 2.7- Summary of Impacts of Alternatives

	Alternative A: No Action	Alternative B: Restore Fish Passage and Minimize Future Maintenance Needs	Alternative C: Restore Fish Passage and Maximize Long-Term Management Flexibility
Geology, Soils, and geohazards	Under Alternative A, there would be no short-term risks to geologic or soils resources, or geohazards, as there would be no scheduled or planned actions at these sites. Routine maintenance of the existing facilities would result in negligible adverse short-term impacts. The condition of these facilities is such that they are subject to failure in the future, resulting in the potential for minor to moderate long-term adverse impacts under Alternative A. These impacts center on the risk of exacerbated stream channel erosion and the potential for catastrophic culvert failures.	The potential impacts associated with implementation of Alternative B on geologic and soils resources, and on risks from geohazards are adverse, and negligible to minor in the short term, and beneficial in the long term. Short-term impacts include minor excavation of stream channel banks and beds, soil compaction and erosion due to heavy equipment traffic, and installation of short segments of riprap revetment on stream banks. Long-term effects would be decreases in the risk of culvert failures and decreases in unnaturally accelerated channel erosion.	The potential effects of implementation of Alternative C on geologic and soils resources, and on risks from geohazards are adverse, and negligible to minor in the short term, and beneficial in the long term. Short-term impacts include minor excavation of stream channel banks and beds, and soil compaction and erosion due to heavy equipment traffic. Long-term benefits would be reduced risk of culvert failures and decreases in unnaturally accelerated channel erosion.

Air Quality	Under Alternative A, there would be no heavy equipment mobilized, except on an emergency basis. These repairs may cause degradation of air quality due to equipment exhaust and dust production. Emergency repairs to culverts would likely take place during seasonal periods in which precipitation and high soil moisture would minimize air quality effects from heavy equipment. Effects on air quality from Alternative A would not effect short-term air quality conditions, but could result in localized minor adverse effects in the long term.	Under both Action Alternatives production of dust and equipment would be similar. The NPS would require work to comply with the BAAQMDs Feasible Control Measures for PM10 and ensure that equipment meets vehicle emissions standards. These mitigation measures are described in Appendix B of this document. With these measures in place, the Action Alternatives (B & C) would result in minor, short-term, adverse impacts to the project Sites. There would be no widespread or long-term impacts to air quality as a result of implementation of the Action Alternatives. Impacts to Air Quality may be slightly greater under Alternatives B or C, because under these proposals culvert replacement activities would take place during summer months in order to protect aquatic resources. This is in contrast to Alternative A, which may require the replacement or repair of culverts as emergency actions during winter months, when atmospheric conditions and high soil moisture content would reduce the effects of fugitive dust and vehicle emissions.	Same as Alternative B

Soundscape	Under Alternative A there would be no heavy equipment mobilized, except on an emergency basis, which could cause increases in noise levels. Emergency repairs to culverts would likely take place during or immediately following winter storms during periods in which atmospheric conditions would minimize noise effects from heavy equipment, and when there is relatively little use of the project areas by humans. There would be no effect on soundscape in the short term, but in the long term, localized effects on soundscapes would be minor and adverse.	Under both Action Alternatives the potential for cumulative effects on natural quiet would be similar. Impacts would be minimized by Best Management Practices, and the relative acoustic isolation of individual project sites and the naturally high ambient noise levels at some project sites. Noise impacts due to incremental effects at each of the 6 project sites considered in this document vary by site and alternative. At all sites under Alternatives B and C, heavy equipment use will create minor noise impacts at the sites and on access roads during construction activities. At some sites the potential need to anchor culvert structures with pilings could create additional noise impacts. At these sites, if pile driving is required, noise impacts would increase to moderate levels for very limited (1-2 day) period. Under the action Alternatives, short-term impacts to natural quiet would be moderate in intensity and adverse. There would be no long-term impacts to natural quiet as a result of implementation of the Action Alternatives.	Same as Alternative B

Hydrologic and Geomorphic Processes, including Water Quality	Under Alternative A, there would be negligible short-term impact to hydrologic or geomorphic process, or water quality as a result of routine maintenance of the existing facilities. In the long term, there is potential for minor to moderate long-term adverse impacts under Alternative A. Without replacement, Mt. Vision and Estero Road crossings are at the greatest risk of catastrophic failure resulting in localized moderate impacts to these resources in the long term. The other sites are lower in the watershed, and the potential for failure is lower, resulting in minor localized adverse long-term impacts. These impacts center on the risk of exacerbated stream channel erosion and the potential for catastrophic culvert failures.	The potential impacts associated with implementation of Alternative B on hydrologic process, geomorphic process, and water quality are adverse, and minor to moderate in the short term. Short-term impacts include excavation of stream channel banks and beds, soil compaction and erosion due to heavy equipment traffic. Localized moderate impacts are described at sites that would include installation of boulder cross-vanes or large-scale riprap armoring along with structure replacement. The restoration of more natural hydrologic and geomorphic process to these watersheds would be beneficial in the long term. In the long term, there would be no effect on water quality.	Same as Alternative B

Impacts to floodplains, wetlands, and riparian zones	The overall effects of Alternative A or No Action on floodplains, wetlands, and riparian zones are shown in Table 5.14 below. The current routine maintenance and management of existing crossing facilities would, in general, potentially have adverse, long-term effects on these natural resources, ranging from negligible to moderate in magnitude. Most of the floodplain, wetland, and riparian zone conditions at the project sites are relatively stable, therefore, most of the potential impacts would result from failure of existing structures, particularly at sites that have infrastructure rated as being in "poor" to "fair" condition and that have poor stream channel conditions (e.g., large differences between upstream and downstream channel elevations). There would also be some potential for impact from future repair and maintenance of structures. Under Alternative A, the no effect to floodplains, wetland, or riparian zones would occur as a result of direct activities. The long-term potential for structures to fail would result in minor to moderate impacts in the long term.	The overall effects of the proposed actions on floodplains, wetlands, and riparian zones are shown in Table 5.15 below. The proposed actions would, in general, have only negligible long-term impacts on floodplains, wetlands, and riparian zones associated with construction-related fill activities and subsequent changes in stream channel conditions. While riparian areas impacted by excavation and tree removal would take more than 2 years to recover to pre-construction conditions, the proximity of seed and vegetative fragment sources would ensure that these impacts are not permanent. There would also be some potential for impact from future repair and maintenance of structures, but the need for and frequency of maintenance and repair would be less than in Alternative A.	The overall effects of the proposed actions on floodplains, wetlands, and riparian zones are listed in Table 5.16. The overall effects of Alternative C at all sites except Lower Laguna are the same as those discussed for Alternative B. At Lower Laguna, the proposed actions would have slightly less impact on floodplains and wetlands than in Alternative B, although impacts would still be characterized as minor adverse in the short-term and negligible adverse in the long term. The potential for impact from future repair and maintenance of structures might be slightly higher under Alternative C then with Alternative B,, but is still lower than under Alternative A.
Wildlife	Under Alternative A, there would be no short-term or long-term effect on wildlife resources.	Under Alternative B , project activities would result in localized effects to wildlife associated with vegetation removal, staging areas, and the noise of project activities. These short-term effects are considered minor and adverse. In the long term, the project would result in beneficial effects to aquatic species associated with expansion of stream conveyance capacity.	Same as Alternative B

Special Status Species - General	Alternative A would not result in direct action and therefore would cause minimal impacts in the short term. However, in the long term, the potential catastrophic failure of some existing structures could result in minor to moderate localized impacts to special status fish, Essential Fish Habitat, and amphibian critical non-breeding habitat within the project area. Table 5.18 summarizes localized effects on specific special status species categories.	Both build alternatives (B and C) are considered to have the same impacts on special status species and habitat. In general, short-term impacts to habitat are followed by benefits to habitat in the long term. There is no proposed habitat conversion (e.g. pond to marsh). All sites are riparian and will recover to riparian habitat. Specific localized effects are shown in Table 5.19. Project BMPs (Appendix B) would provide further protections to insure that potential for direct take is minimized. Overall, the project would result in minor short-term adverse impacts to special status species and habitat, and beneficial long-term effects. Implementation of either Alternative B or C would not result in impairment of park special status species.	Same as Alternative B
Special Status Fish Species	Alternative A would result in no effect in the short term, but the potential for catastrophic failure and associated large-scale geomorphic and hydrologic adjustments could result in localized minor to moderate adverse impacts to special status fish and Essential Fish Habitat in the long term.	The restoration activities at all sites will require capturing fish and moving them to adjacent habitat. It is likely that steelhead would be captured from all sites except North Home Ranch Creek. In addition, construction activities will result in direct impacts to specific reaches of Essential Fish Habitat. In the short term, Alternative B would result in minor adverse impacts to special status fish and Essential Fish Habitat. In the long term, restoration of fish passage and creation of suitable, stable habitat within the project area will be beneficial at the local and watershed scale for both special status fish and Essential Fish Habitat.	Same as Alternative B
Special Status Plant Species	Alternative A would not effect special status plant species in the short term or long term.	Surveys of the project areas did not document special status plant species within the construction areas. As a result, Alternative B would not result in effects to special status plant species in the short or long term.	Same as Alternative B
Special Status Invertebrate Species	Alternative A would not effect special status invertebrate species in the short term or long term.	Alternative B would not effect special status invertebrate species in the short or long-term.	Same as Alternative B

Special Status Amphibians and Reptiles	Alternative A would result in no effect in the short term., The potential for catastrophic failure and associated large-scale geomorphic and hydrologic adjustments could result in localized minor adverse impacts to special status amphibian non-breeding critical habitat. Alternative A would not effect special status reptile species in the short or long term.	It is possible that the California red-legged frog and the northwestern pond turtle will be encountered as part of the project. Proposed BMPs (Appendix B) would minimize the potential for direct take of individuals. If individuals are found in the project construction area during the construction period, they would be trapped and relocated by a qualified NPS biologist. In addition, construction activities would result in direct impacts to specific reaches of critical non-breeding habitat. No special status invertebrates or reptiles were identified as part of the project planning surveys. It is known that northwestern pond turtles do occur within the watershed and could be encountered. As a result, Alternative B could result in minor short-term adverse impacts to special status amphibians, reptiles, and critical non-breeding frog habitat. In the long term, the project would benefit special status amphibians or reptiles.	Same as Alternative B
Special Status Avian Species	Alternative A would not effect special status avian species in the short term. Catastrophic failure of some facilities could result in adverse downstream impacts to riparian habitat and potential neotropical bird nesting areas. If this occurred, Alternative A would result in minor adverse effects in the long term.	With construction timed to avoid bird breeding season, and BMPs described in Appendix B, the build alternatives (B and C) would result in short-term, negligible to minor impacts to special status and protected birds, and potential breeding riparian habitat. In the long term, effects are considered negligible. While the recovery of riparian vegetation to its existing levels of cover and maturity would take more than two years, the actual of riparian habitat impacted relative to overall riparian habitat is very small.	Same as Alternative B
Special Status Mammal Species	Alternative A would not affect special status mammal species in the short term or long term.	The project areas are not considered viable habitat for the Point Reyes mountain beaver (FSC), which occurs further upstream in colluvial hollow type habitat and not in active stream channels. Alternative B would not affect special status mammal species in the short term or long term.	Same as Alternative B

Cultural Resources	The overall effects of Alternative A or No Action on cultural resources are shown in Table 5.20 below. The current routine maintenance and management of existing crossing facilities would not result in impacts to documented cultural resources. Most of the potential impacts would result from failure of existing structures, frequent repair and maintenance of structures in the future, and potential geomorphic and hydrologic changes in creeks. These changes would include alterations in stream course and erosion patterns. In general, there would be no short-term impacts to cultural resources under Alternative A, and in the long term effects are considered negligible.	The overall effects of the proposed actions on cultural resources are shown in Table 5.21 below. Alternative B would have no effect at Mt. Vision, Estero, and Lower Laguna sites. Treatment actions at the remaining 3 sites would result in short-term negligible to minor effects. Long-term beneficial effects on cultural resources are greater flow conveyance and improved condition of installed infrastructure which will reduce the potential for flooding or catastrophic failure of the crossings.	The overall effects of the proposed actions on cultural resources are the same as those in Alternative B, with the exception of Upper Laguna, where the activities would result in negligible, rather than minor short-term adverse effects.
Visitor Use and Visitor Experience, and Recreational Use	The overall effects of Alternative A on recreation resources, visitor experience, and aesthetic resources are shown in Table 5.23. The current maintenance and management regime of existing crossings would have no effect on visitor experience and recreational resources and negligible effects on park aesthetic resources in the short term. The high potential for a catastrophic failure of the Estero and Mt. Vision Roads infrastructure could considerably lengthen the amount of time that associated trail systems would remain inaccessible. In addition, accessing the Estero Trail and Bucklin Trails from other starting points is considerably more difficult than for most of the other trail systems. Therefore, Alternative A in these project sites could result in no effect in the short term, but potential moderate adverse impacts to visitor experience and aesthetic resources in the long term.	The overall effects of Alternative B on recreational resources, visitor experience, and aesthetic resources are listed in Table 5.24. The proposed actions would involve adverse, short-term, minor impacts to visitors because of temporary access road and trail closures, increased traffic, noise, and potential delays associated with construction equipment. However, these adverse impacts would be offset in the long term by beneficial effects including reductions in the potential for access road and trail closures due to flooding, emergency infrastructure replacement, and frequent repairs and maintenance. In addition, there would be an improvement in the overall aesthetic resources of the park that would increase the value of the visitor experience	Same as Alternative B

Public Health and Safety, and Transportation	The overall effects of Alternative A on public safety are shown in Table 5.25 below. The current routine maintenance and management of existing crossing facilities would result in negligible adverse, short-term effects on public safety and transportation. In the long term, potential for catastrophic failure is highest at Estero and Mt. Vision road crossings, impacts considered moderate and adverse.	The overall effects of Alternative B) on public safety and transportation are listed in Table 5.26. In general, the proposed actions would have beneficial, long-term effects on public safety and adverse, short-term effects on transportation. Improvements in public safety would range from minor to moderate, depending on the risk for catastrophic failure of the existing facilities and the potential for flooding. The NPS would ensure that impacts to residents remains minor by maintaining access to homes, ranches, and facilities during construction.	Same as Alternative B

3.0 Project Setting and Affected Environment

The project subwatersheds contain important biological, physical, and cultural resources meriting evaluation under the 3 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 actions. The first section, Project Setting, is presented to foster a fuller understanding of the project areas (see Figure 1.1). The Affected Environment description is required (by NEPA regulations [Section 1502.15]) to provide an account of the specific resources that could be affected, directly or indirectly, by project implementation. Many of these resource topics include a brief discussion of pertinent regulations because an evaluation of existing resource conditions is difficult unless placed in a regulatory context (e.g., air quality, water quality). More detailed information on regulations pertaining to this project appears in Chapter 6.0. Information provided in this chapter was gathered from literature reviews, existing data, and primary field surveys within the project areas.

3.1 Project Setting

3.1.1 Regional Context

The project area is located in central California, in western Marin County, approximately 40 miles northwest of the city of San Francisco. It is comprised of federal lands managed by the Point Reyes National Seashore, a unit of the National Park System, and is within 50 miles of the 9-county San Francisco Bay Area, the fifth largest metropolitan area in the United States.

The more developed regions of the San Francisco area surround the bay itself, with smaller cities, towns, open space and agricultural areas in an outer ring around an urban core. Forty-eight percent (159,044 acres) of the 332,800 acres in Marin County is held as parks, open space and watershed (Marin County Community Development Agency 2002). Thirty-six percent (119,808 acres) is in agricultural use. Developed lands constitute only 11% of the county while 5% of the county has future development potential.

While eastern Marin is heavily developed along the Highway 101 corridor, western Marin is primarily rural, with scattered small unincorporated towns that serve agriculture, local residents and tourism. Roughly 90% of the 250,000 residents of Marin County live in the eastern half of the county along the major transportation corridor -- State Highway 101. PRNS is bounded to the north, west and southwest by the Pacific Ocean and to the east by the residential communities of Inverness, Inverness Park, Point Reyes Station, Olema, and Dogtown. The town of Bolinas is south of PRNS at the southern tip of the peninsula. An estimated 3,800 permanent residents live in the towns and communities close to the project area from the tip of Tomales Bay in the north to Stinson Beach in the south (US Census Bureau 2000). This population figure does not include the many part-time residents of western Marin who maintain second homes in the area.

3.1.2 Project Area Overview and History

The project areas are located in the western portion of PRNS. The 4 creeks, East Schooner Creek, Home Ranch, North Home Ranch, and Laguna, flow into Drakes Estero, a large estuarine embayment located south of the Lighthouse and Drakes Beach. Drakes Estero is comprised of several “esteros” or bays, including Creamery Bay, Schooner Bay, Home Bay, and Estero de Limantour. East Schooner Creek flows into Schooner Bay, and Home Ranch and North Home Ranch drain into Home Bay. While, historically, Laguna Creek constituted its own watershed, flowing directly into the Pacific, modifications have resulted in a physical connection to Limantour Pond through a drainage ditch. Limantour Pond flows into the south end of Limantour Estero via a culvert underneath the Limantour Beach access levee.

The original inhabitants of the Drakes Estero watershed were the Coast Miwok Indians. Contact between the Coast Miwok and Europeans first occurred on the Marin County coast as early as 1579, when Sir

Francis Drake spent 5 weeks on the coast to repair his damaged ship (Kroeber 1953). Subsequent ranching and settlement by Mexicans and Americans further displaced the Coast Miwok from their homes and subjected the group to killing and epidemic diseases (Cook 1976). Most experts believe that Point Reyes contains the site of the first recorded English/Native American contact in North America. According to experts, Francis Drake is likely to have landed here in 1579 to careen his ship before sailing across the Pacific on a circumnavigation of the globe. In 1595, the first recorded shipwreck on the West Coast occurred when the Spanish galleon San Augustin was wrecked in what is now Drakes Bay. Since that year, Point Reyes history is replete with accounts of shipwrecks, some of which were later identified in underwater archeological surveys. It was Spanish sailor/explorer Sebastian Vizcaino who named Point Reyes (Punta de los Reyes) in 1602.

The project area is within the Rancho Punta de Los Reyes (Sobrante) Spanish land grant. Antonio María Osio bought approximately 9,000 acres of lands and then petitioned the Mexican governor for the remaining surplus or "Sobrante" land on Point Reyes, calling the new ranch, the Rancho Punta de los Reyes Sobrante (Livingston 1994). Following a tumultuous series of ownership changes, a group of partners in a San Francisco law firm owned the entire Point Reyes Peninsula and divided the peninsula into more than 30 tenant-occupied ranches (Livingston 1994). These ranches were identified by letters of the alphabet. Ranches D, E, F, G, N, Home Ranch, Drakes Head, and Ranches R, S, and T (later becoming the New Albion, Laguna, and Muddy Hollow Ranches respectively) border the Drake Estero watershed. Oscar Shafter, a principal in the law firm that owned Point Reyes, and his brother, James, built their house at the center of what would become a legendary dairy empire: Home Ranch, north of Home Bay in Drakes Estero (Livingston 1994). Most of the tenants who managed these ranches for more than 80 years were of Swiss, Italian and Portuguese descent (Livingston 1994). Eventually, the Shafter-Howard lands were sold, many of them to long-term tenants, including the Gallaghers (F Ranch), Murphy's (Home Ranch) and the McClures (G Ranch) (Livingston 1994).

Most of the ranches in the Drakes Estero watershed specialized in dairying, cheese and butter production, although some moved into beef cattle ranching and artichoke farming. Roads were needed to connect the ranches with outside markets. The original road from Olema to the Point Reyes Peninsula bisected the Drakes Estero watershed, going over the Inverness Ridge to the Laguna Ranch, along the Muddy Hollow Road through Home Ranch and several other ranches (Livingston 1994). These roads required infrastructure to cross the numerous drainages flowing into Drakes Estero. A new road was built in 1875 that follows the current Sir Francis Drake Boulevard path (Livingston 1994). Ranches in the Drakes Estero watershed also used shipping to reach outside markets with schooners that would dock at wharves in Schooner Bay, Limantour Bay below the New Albion Ranch, and below Drakes Head Ranch (Livingston 1994).

These ranches and associated infrastructure created inevitable changes in the Drakes Estero watershed. Despite these impacts, bountiful natural resources continued to persist in the Drakes Estero watershed. Watershed creeks supported large, sustained populations of steelhead trout. Anecdotal reports, as well as family photos, document many of the anadromous fish species, caught on their return to spawn in Home Ranch or Laguna Creeks. Descriptions of past stream condition paint the picture of a much more stable watershed condition, where riders used to take their horses beneath the bridge at Home Ranch, or the not-so-distant memory of park employees watching trout spawn on gravel bars of Muddy Hollow and Laguna Creek.

Point Reyes had been the object of land protection since the first park feasibility study was authorized in the 1930s. As pressure to develop lands along the seashore increased, so did the momentum to protect it. Within the Coastal Watershed Restoration project areas, large tracts of agricultural lands had been sold to developers and were already being subdivided and having houses constructed, including lands in Limantour Estero. It was this development pressure that triggered Congress to push forward with legislation in September 1963 to protect the coastal resources unique in Point Reyes. While the legislation was being written in 1962, landowners undertook 'improvement' projects to increase the value of their assessed land. These alterations imposed a number of major physical impacts to the coastal watersheds within Drakes Estero.

Although ownership of the ranches was transferred to the NPS, many of the owners remained on the land through long-term leases. PRNS' enabling legislation not only protects coastal resources, but allows for preservation of the pastoral landscape created by more than 100 years of dairying and beef cattle ranching.

Following acquisition of the property by the NPS, many of the rancher-built facilities began to degrade through lack of maintenance. The culverts on Mt. Vision Road and Estero Road were replaced following catastrophic flood events in 1982. Because threats to the viability of anadromous species populations were not a concern at the time, replacement culverts were installed without consideration of fish passage.

3.1.3. Park Management Zoning and Current Land Use

The project areas fall within the boundaries of PRNS. PRNS and GGNRA share a general management plan (NPS 1980), which uses several zoning designations to guide park management and land use. The project areas lands fall under one of two general management zones: Natural Resource Zone and Historic Resource Zone. The Natural Resource Zone includes pastoral lands, natural landscape areas, sensitive resources, designated wilderness and marine reserves. Historic ranches, the Point Reyes Lighthouse and the lifesaving station are included in the Historic Resource Zone.

The project areas are incorporated into one of two Natural Resource Zones: Pastoral Landscape Management Zone and Natural Landscape Management Zone. Approximately 19,000 acres of PRNS have been retained in agricultural production within the pastoral zone that supports beef and dairy production. The Northern District of GGNRA contains an additional 10,500 acres leased for cattle grazing. Pastoral operations presently include 7 dairy and ten beef cattle ranches. The General Management Plan (GMP) indicates that, at a minimum: agricultural buildings and open grasslands will be retained in these areas; where feasible, livestock grazing will continue within the limits of carefully monitored range capacities; and future resource management studies could alter the configuration of this zone (NPS 1980). Estero Road, Mt. Vision Road, and North Home Ranch project areas are in the Pastoral Landscape Management Zone. Estero Road crossing provides access for park visitors using the Estero Trail, as well as the current lessees of Home Ranch. The North Home Ranch crossing is almost exclusively used by lessees and staff of Home Ranch and NPS staff. The Mt. Vision Road crossing provides access for the Inverness Ridge and Bucklin Trails, a FAA land-based transponder, as well as two NPS staff houses.

The Natural Landscape Management Zone applies to those lands containing important natural resources that are not within the designated wilderness of PRNS. The largest track is the southern half of the Bolinas Ridge, lands buffering Limantour Road and Limantour Beach and the Marshall Beach area north of Tomales Bay State Park. GMP mandates that natural resources and processes in these areas remain as undisturbed as possible given a relatively high level of park use (NPS 1980). The Olema Valley is to be managed to maintain the visual contrast between woodland and open grassland (NPS 1980). Upper and Lower Laguna project areas are within this zone. The Upper Laguna crossing provides access not only to a park trailhead, but to park staff housing. Lower Laguna falls along the Coast Trail leading to Coast Camp. While trailheads do not necessarily require crossing facilities, vehicular access to Coast Camp and park housing must be maintained for operational and maintenance purposes.

The Historic Resource Preservation Zone includes spaces and objects that are primarily managed and used to facilitate public enjoyment, understanding, and appreciation of their historic values. Since the adoption of the 1980 GMP, many of the historic structures in the park have been adaptively re-used under the agricultural leases. Others house interpretive exhibits, public associations and park administrative offices or provide housing for park employees. The GMP mandates that these historic resources be protected from damage and deterioration. The road crossing at Home Ranch is not part of the historic complex, although it is surrounded by historic structures.

3.2 Affected Environment for Impact Analysis

3.2.1 Geology and Soils (including Geohazards)

The character of the Point Reyes Peninsula has been shaped and remains defined by its association with the San Andreas Fault System. The San Andreas Fault Zone (SAFZ) forms the active tectonic boundary between the Pacific Plate and the Continental North American Plate. The San Andreas Fault is perhaps the best known fault in California, although there are more than 20-30 other faults in the San Francisco Bay region. In 1906, movement along the San Andreas Fault caused an earthquake with an estimated magnitude 8.3 on the Richter scale. Clark and Brabb (1997) describe similarities between Eocene and Miocene depositional sequences of the Point Reyes and Monterey peninsulas suggesting displacement of the Point Reyes Peninsula of as much as 150 km (94 mi) along the San Gregorio Fault in the last 11 million years. Recent research on the San Andreas Fault has allowed researchers to document the occurrence of 10 additional large-scale land movement events in the past 2,500 years, with a recurrence interval of one major event every 250 years (Zhang et al. 2003), and a distance between events ranging from 150-300 years (Niemi Personal communication 2004). Due to different rock types, the geomorphology, hydrology, weather, soils, and plant communities east of the fault differ in many ways from that of the peninsula.

Salinian granite underlies nearly the entire peninsula, and is exposed in the areas of Inverness Ridge, Tomales Point, and the Point Reyes Headlands (Figure 3.1). The granite is unconformably overlain in the southern part of the peninsula by Monterey Shale which is exposed along the coastline from Drakes Bay south to Bolinas (Konigsmark, 1998). Coastal wavecut benches and flooded valleys are the result of sea level fluctuations during the Pleistocene and Quaternary tectonic uplift (Scherer and Grove, 2003) with rates of uplift up to 1.0 mm per year along the folds (Grove 2003). The Point Reyes plain, extending from Inverness Ridge west to the headlands is underlain by siltstone and mudstone of the Purisima Formation, which also occurs in the Santa Cruz Mountains (Clark & Brabb, 1997). The headlands present the most unique exposed formation within the park, the Point Reyes Conglomerate, a sandstone conglomerate with rounded chert, volcanic, and granitic cobbles. It is best exposed along the Lighthouse steps and is most similar to a conglomerate that occurs on Point Lobos, 100 miles to the south (Evens, 1993).

The Olema Valley, extending from Bolinas Lagoon to Tomales Bay is representative of the SAFZ. The Valley ranges in width from 1,500 to 7,000 feet. The Olema Valley includes a variety of fault-associated topographic features including linear ridges and drainage patterns, parallel stream systems, offset rows of trees and fences, and a series of sag ponds. The surface rupture caused by the 1906 earthquake extended from Bolinas Lagoon to Tomales Bay, with lateral displacement ranging from 14 to 20 feet in the Olema Valley (Gilbert 1908).

Bedrock east of the fault (generally east of Highway 1) is the Franciscan Complex that makes up much of California's Coast Range. The Franciscan Complex is believed to be a fossil accretionary wedge of sediment that used to fill the trench of a subduction zone. It is mostly composed of greywacke, sandstone and shale with different grades of metamorphosis. Some parts of the Franciscan Complex are a mélange, including highly metamorphosed, low-grade mudstone, siltstone, and sandstone with occasional inclusions of limestone, chert, serpentinite, eclogite, and amphibolite conglomerate (Galloway, 1977). The Franciscan Complex is highly unstable and is known for slope instability, thin soils, and high runoff rates.

During the last 160 years, the San Andreas Fault system has produced numerous small-magnitude and a dozen moderate to large (magnitude>6) earthquakes in the San Francisco Bay Area (USGS 2003) although there have been no extremely large earthquakes since 1906. The Loma Prieta earthquake, the most recent catastrophic event in the Bay region of the SAFZ, occurred in 1989 in the Santa Cruz Mountains approximately 14 km north of Santa Cruz. It caused tremendous damage, including collapse of a portion of the Oakland Bay Bridge. Geologists have found that earthquakes do not occur randomly, but rather are clustered, because as strain is released in one area, it may actually increase in another (USGS 2003). This clustering has led geologists to estimate that the probability of an earthquake of magnitude 6.8 or larger occurring during the next 30 years in the San Francisco Bay region is approximately 62 % (USGS 2003).

Earthquakes are associated with several major hazards: ground shaking, surface fault or ground rupture, ground failure (e.g., liquefaction, settling, and lurching), landslides, and inundation from tsunamis or tidal waves or waves in enclosed water bodies such as lakes and reservoirs. The potential for a surface fault rupture or ground rupture is limited to areas along the fault or within 250 feet of the fault; the San Andreas

Fault lies several miles eastward of the project areas. However, the potential for other hazards is not restricted to fault areas and can impact hundreds of miles, particularly in regions with soft soils.

In general, the destructiveness of earthquakes to humans namely, injury, loss of life, and property damage, are influenced by epicenter proximity, earthquake magnitude, a given structure's resistance to earthquakes (e.g., modern structures are constructed so that they flex during earthquakes), and the substrate or geologic materials upon which a structure is built. For example, one of the reasons that the 1906 earthquake was so destructive is that much of San Francisco was built upon imported sand fill that became unstable during plate movement. Loose, saturated materials such as sands can become fluid-like during an earthquake, suddenly losing strength and behaving almost like quicksand. This phenomenon, called liquefaction, typically occurs where groundwater is shallow and the substrate is clean, poorly consolidated, loose sand.

Most of the project areas in which crossing facilities would be constructed within Quaternary alluvium associated with runoff from marine sedimentary deposits, including mudstone, siltstone, and greenish sandstone (Clark et al. 1984, U.S. Soil Conservation Service 1985). Between Inverness Ridge and Point Reyes Headlands, the Purisima formation is as much as 16,170 feet thick. In this formation, greenish sandstone is overlain by shale, which intermixes with sand and grades into siltstone and mudstone (Evens 1993). "The distinctive, cream-colored bluffs at Drake's Beach, which may have reminded Sir Francis Drake of the white cliffs of Dover, are the most visible exposure of this formation " (Evens 1993).

Within this general geologic landscape, dictated by plate movement and uplift, the project areas represent somewhat mobile features whose form is governed by a combination of the sediment depositional history and "basement geology" such as bedrock. The sites are overlain by quaternary alluvium. Geotechnical studies conducted as part of the project design revealed that the Estero Road, Mt. Vision Road, and North Home Ranch crossings actually overlay some deep alluvium; bedrock was not encountered even with 3-10 meters of drilling. A geotechnical investigation is currently being conducted to evaluate the potential for liquefaction and the suitability of these areas for infrastructure development.

Most of the project areas still show the effects of either scour or deposition associated with the 1982 rainfall-induced debris flow events. While PRNS lies on one of the more infamous North American faults, the recent geologic history of this area appears to have been influenced more by flooding events such as the 1982 (100-year), 1998 (10-year) flooding events and the 1995 Mt. Vision fire. Each of these events led to mobilization of enormous amounts of sediment within the PRNS watersheds, including Drakes Estero. The 1906 earthquake also caused some landslides in Olema Valley. Should major flooding or a massive earthquake take place in the future, it is likely that more erosion will occur on the rather unstable Inverness Ridge and consequently increase the amount of sediment in the Drakes Bay watershed.

According to the Soil Conservation Service (now Natural Resources Conservation Service) soil map (SCS 1985) there are 2 soil types or complexes within the project areas. With the exception of Upper Home Ranch, the project areas fall within the Rodeo clay loam, 2 -15% slope, soil mapping unit. This hydric soil is described as a very deep, poorly drained material that formed from alluvium of various kinds of rocks in narrow valleys and basins (SCS 1985). Often, a perched water table is present above the subsoil from December through April. The soil type for the North Home Ranch project area was mapped as Humaquepts, seeped, another hydric soil. This unit consists of nearly level to sloping, poorly drained soils in small drainages with a water table that is at or near the surface throughout the winter and spring (SCS 1985). In general, the project areas appear to match the mapped soil type. Composition of the streambed itself varies according to project area. Most of the project areas have primarily cobble and gravel substrate with some sand intermixed (NHC 2002). However, Home Ranch and Lower Laguna both had predominantly sandy substrates with small gravel (NHC 2002).

3.2.2. Air Quality

PRNS is classified as a mandatory Class I area under the federal Clean Air Act (CAA) and amendments. Title I of the CAA Amendments of 1990, Part C, "Prevention of Significant Deterioration of Air Quality,"

Section 162, defines Class I areas as including national parks larger than 6,000 acres. The areas must have been in existence on the date of the enactment of the CAA amendments in 1977.

The NPS, as the federal land manager of PRNS, is responsible for the protection of the park from ambient air quality impacts. It is mandated to preserve visibility and to protect plants, animals, soils, water quality, cultural and historic structures from the effect of contaminants. PRNS is located in the San Francisco Bay Area Air Basin (SFBAAB) and is under the jurisdiction of the Bay Area Air Quality Management District (BAAQMD). The SFBAAB is composed of the counties of Alameda, Contra Costa, Napa, San Francisco, San Mateo, and Santa Clara, along with the southeast portion of Sonoma County and the southwest portion of Solano County. It covers an area of approximately 5,540 square miles. The BAAQMD is directly responsible for the protection of air quality and implementation of local and State Implementation Plan (SIP) measures within the Bay Area region. The BAAQMD regulates air quality under the auspices of the California Air Resources Board (CARB) and the U.S. Environmental Protection Agency (EPA), Region 9. Both CARB and the EPA have general oversight responsibilities to ensure that local rules, regulations and stationary source permits consistently maintain California and National Ambient Air Quality Standards (AAQS).

A cooperative program, the Interagency Monitoring of Protected Visual Environments (IMPROVE), between the EPA, federal land managers, and state air agencies, was formed to monitor visibility in Class I areas. Data published in a recent IMPROVE report shows that visibility at PRNS improved during the period of 1996 to 1999 primarily due to a decrease in nitrate particulates, a major component of visibility blocking material in coastal California. Particulate nitrate is formed from nitrogen oxide and hydrocarbon gases emitted into the atmosphere from fires, diesel engines, and other sources (Malm 2000). Monitoring by the NPS found no ozone exceedences at PRNS under either the California or federal standard. Park air resources are rated as having low exposure to ozone, sulfur, and nitrogen emissions and low potential for acidification of surface waters. A recent NPS report states: "There are no significant air pollution effects concerns in this park [PRNS] at the present time" (Sullivan, et.al. 2001).

In 2000, Marin County had a total population of 247,289 (U.S. Census Bureau 2000). Most of Marin's population lives to the south and east of the project areas; other populated areas (including Petaluma in Sonoma County) are located in a more easterly direction, inland from Point Reyes. In the vicinity of PRNS, a scattered population lives in the small towns of Inverness, Inverness Park, Olema, and Bolinas, Point Reyes Station, and along Highway 1. Air quality within the coastal portion of rural West Marin can be affected by problems outside the immediate vicinity of PRNS. In general, the BAAQMD has been unable to attain the ozone (O_3) and carbon monoxide (CO; pertinent to urbanized areas only) standards set by the AAQS for the Bay Area. These air quality problems have the potential to affect seemingly unpolluted coastal regions because of wind, air temperature, gradients, and local and regional topography.

The project areas enjoy a Mediterranean climate characterized by warm, dry summers and cool, damp winters. The coastal portion of the SFBAAB differs, however, somewhat dramatically from inland areas because oceanic influences moderate temperature swings and maintain a consistent cool and moist microclimate. The climate is controlled by a semi-permanent high-pressure system centered over the northeastern Pacific Ocean. This high pressure system blocks summer precipitation, keeping it low (<0.2 inches per month), but it also makes summer cool because of the fog belt that develops when the marine air is cooled as it passes over the offshore upwelling region. Conversely, in the winter, proximity to the ocean keeps the coastal regions relatively warm (BAAQMD 2003a). Average temperatures in PRNS during the summer vary from about 45º to 75º. During the winter, average temperatures vary from about 35ºF to 60ºF. Approximately 84% of the average 38.2 inches of rainfall every year occurs during November through March, generally in association with storm systems. The warmest months are September and October, when temperatures are in the mid- to high 60s and offshore breezes are dominant (BAAQMD 2003).

Oceanic influences also affect wind direction and speed. Many areas of PRNS, particularly along the Drakes Bay, the Lighthouse, and Point Reyes Headlands, are exceptionally windy. Wind speed along the west Marin Coast averages 8- to 10 mph (BAAQMD 2003a). During the winter, the predominant regional surface winds flow from the north-northeast (Bell 1958). During spring and summer, stronger north-northwest winds dominate (Bell 1958). These northwesterly winds are primarily caused by the

combination of high pressure offshore and the warmer air inland. These winds blow off the ocean and are slowed down, if not intercepted completely, by the complex terrain of the Bolinas Ridge (BAAQMD 2003). During the fall transition, warm easterly winds from the hot, dry inland areas often break through to the coast.

Bolinas Ridge provides a topographic barrier air pollutants from San Francisco Bay since winds play a major role in dispersing pollutants far from respective sources. Air pollution in the region is moderated by strong, westerly winds most of the year. Other sources of pollutants are inversions. When cold air becomes trapped under warm air, the air masses cannot mix, and pollutants begin to accumulate. The frequent occurrence of temperature inversions over PRNS could concentrate air pollution levels near the ground. Pollutants are more concentrated near the ground during colder weather or after sunset. In general, "the influence of the marine air keeps the pollution levels low" (BAAQMD 2003b).

The air pollutants of greatest concern in the SFBAAB are ozone, carbon monoxide, and inhalable particulate matter (particulate matter <10 microns in diameter, or PM10). The proposed action is not expected to generate problematic amounts of other pollutants. Consistent with guidance the BAAQMD and standard industry practice, this EA focuses on the pollutants of greatest concern in the area. Their characteristics are summarized in Table 3.1.

Table 3.1. Overview of Pollutants of Greatest Concern in the SFBAAB

Pollutant	Sources	Health and Other Concerns
Ozone	Formed by a photochemical reaction in the atmosphere; ozone precursors, including reactive organic gases and oxides of nitrogen (NO_x), react in the atmosphere in the presence of sunlight to form ozone. Ozone precursors are emitted by mobile sources such as vehicles, and by stationary combustion equipment.	A severe eye, nose, and throat irritant; increases susceptibility to respiratory infections. An oxidant; can cause substantial damage to synthetic rubber, textiles, and other materials. Produces leaf discoloration and cell damage in plants.
PM10	Results from many kinds of dust- and fume-producing activities, such as demolition, construction, and vehicular traffic; entrained road dust from motor vehicles accounts for approximately two-thirds of the regional PM10 inventory in the project area.	Health concerns focus on particles small enough to be drawn into the lungs when inhaled (PM10). Can increase the risk of chronic respiratory disease with extended exposure.
CO	Motor vehicles are the primary source of CO emissions in most areas. In the urbanized portions of the San Francisco Bay Area, high CO levels primarily develop during the winter near congested intersections, when periods of light winds combine with the formation of ground-level temperature inversions from evening through early morning. In addition, motor vehicles exhibit increased CO emission rates at low air temperatures.	Combines readily with hemoglobin and thus reduces the amount of oxygen transported in the bloodstream. Effects on humans range from slight headaches to nausea to death.

Sensitive receptors refer to land uses that are considered particularly sensitive to decreases in air quality. The designation typically refers to uses such as residences, schools, libraries, hospitals, and other similar facilities where there are large concentrations of children and young people; the elderly; and/or the chronically ill. Because the project sites are within Point Reyes National Seashore, few sensitive receptors of these types are located near the sites. However, the area is widely used for recreation, wildlife viewing, and scientific research, and these uses are potentially vulnerable to air quality degradation.

The only air pollutant currently measured in the Point Reyes region is PM2.5, small particulate aerosols that affect acid deposition and regional haze. Recent data (1999-2001) indicate a daily average

concentration of 8.3330 ug/m3 or less averaged over these 3 years of data, well below the state and federal AAQSs of 12 and 15 ug/m3, respectively. Since no other ambient air pollutant is measured in this region, air quality data were obtained from other nearby BAAQMD monitoring stations in San Rafael (Marin), Santa Rosa (Sonoma), and Vallejo (Napa). In summary, these stations, which are located in more heavily developed areas, met standards for carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and federal, but not state, standards for ambient particulates smaller than 10 microns (BAAQMD 2003b). Santa Rosa exceeded the state's maximum 24-hour average for ozone twice during the 3-year period and California's one-hour ozone standard once (BAAQMD 2003b).

3.2.3. Soundscapes

One of the intrinsic values of national parks remains the lack of urban noise or the potential for hearing "natural" noises such as crashing waves or singing birds. Unlike more urban parks, PRNS is located in a rural portion of western Marin County and has to contend less with the intrusive influences of urbanization than its sister park to the south, GGNRA. Regardless of location, however, the NPS is directed to preserve, to the greatest extent possible, the natural soundscapes of parks and to protect natural soundscapes from degradation due to noise, defined as "undesirable human-caused sound" (NPS 2000). This is a more stringent standard than set by the federal Noise Control Act of 1972 or most general plans produced by cities or counties.

The federal Noise Control Act required federal agencies to promote an environment free of the noise that can jeopardize public health or welfare. The agency tasked with implementing this act, the U.S. Environmental Protection Agency, established outdoor limits of 55 decibels and indoor limits of 45 decibels averaged through a 24-hour period. In 1994, the Marin County Noise Element mandated that residences, public spaces, and institutions not be subjected to noise levels above an average of 60 decibels over a 24-hour period. Marin County is currently in the process of revamping its General Plan and noise standards.

Major noise producers in most areas include highway traffic, trains, planes, boats, and industry-related machinery within industrial zones. In rural areas such as PRNS, major producers of undesirable human-caused sound are limited to automobile and truck traffic, jet airplanes, individual businesses, agricultural ranches, and individual construction projects. In general, ambient noise levels remain lower in rural areas than in urban areas. In urban areas, ambient noise levels typically range from approximately 60 to 70 dBA, whereas, in rural areas, ambient noise levels range from 40 to 50 dBA. No ambient noise levels are available for PRNS. However, Marin County assessed noise levels on Highway 1 south of Point Reyes Station in 1987 and 2001, and average ambient noise levels climbed from 62 to 65 decibels over a 24-hour period (County of Marin 2004).

The project area is located in the center of PRNS where vehicular traffic constitutes most of the anthropogenic noise sources. In 4 of the project sites, vehicular traffic is extremely low; however, 2 of the project areas parallel Sir Francis Drake Boulevard, the main road for visitors, residents, and park staff traveling, in over 300,000 vehicles per year, to the Point Reyes headlands (NPS 2002).

3.2.4. Hydrologic and Geomorphic Processes, including Water Quality

The hydrologic setting of PRNS includes more than 80 miles of coastline, large estuarine areas, diverse wetlands and a mix of perennial and intermittent streams supporting two federally protected anadromous species, coho salmon and steelhead. The transition from precipitation- and groundwater-derived freshwater at the uppermost extent of watersheds to the tidally dominated Drakes Bay and the Pacific Ocean beyond superimposes a wide range of salinity gradients supporting highly diverse aquatic ecosystems. Drakes Estero captures flow from more than 13.5 square miles of watershed, including Laguna, Muddy Hollow, Glenbrook, Home Ranch, and East and North Schooner Creeks, as well as several smaller unnamed drainages.

With the exception of Mt Vision Road Crossing, the project area represents low gradient sections of 3 perennial creek subwatersheds to Drakes Estero – East Schooner, Home Ranch, and Laguna. Surface water and precipitation running off the steep, upland portions of the Inverness Ridge drains towards Drakes Estero. These waters often carry sediment from the upper portions of the watershed particularly during storm events. Despite the Mediterranean climate, the creeks draining from Inverness Ridge sustain perennial flow, with flow decreasing substantially in the summer and fall.

Movement of water and sediment through the watershed, from Inverness Ridge to Drakes Estero, depends on hydrologic, geomorphic, and sediment transport processes. These processes include flooding, surface water interaction with the groundwater table, lateral movement or meandering of the creek channel, connectivity of the stream with the floodplain, and the movement of boulders, gravel, and fine sediment. Steeper reaches of the watershed often support linear creek corridors with limited floodplain development. As gradient decreases, the width of the creek corridor increases, and so does the potential for the creek to meander or move across the valley floor. Floodplains can help to reduce the velocity and erosive power of flood flows by allowing creeks to store additional floodwaters during storm events. While flooding is often perceived as destructive, flooding is integral to natural processes such as channel stability, detention of fine sediment and other water quality pollutants, and recruitment of riparian plant species. In systems where the magnitude or frequency of flooding has been altered, such as dam-controlled rivers, discontinuities often arise in sediment transport and riparian recruitment that have detrimental consequences for people and wildlife.

Road crossing facilities such as culverts act as stable structures within a watershed, and, over time, become focal points for changes in geomorphic character and stream profile. Such structures limit the natural lateral and vertical adjustments that would otherwise occur in the channel as a result of high flows. As more events occur, the channel upstream and downstream may diverge in geomorphic character as a result of the structure. This disparate trajectory in geomorphic evolution must be considered with respect to planning restoration activities. Simple removal of structures where new physical conditions and gradients have developed could initiate new erosion and instability as the streambed reaches a new equilibrium through upstream erosion.

Several of the project areas show incision downstream of the existing culverts, including Estero Road, Mt. Vision Road, and North Home Ranch. However, channel incision downstream and floodplain widening upstream appears to be minimal, perhaps because bedrock controls or roadbeds have made creekside areas resistant to erosion (e.g., Sir Francis Drake Boulevard at Estero Road, Mt. Vision Road crossings).

3.2.4.1 Streamflow Characteristics

Streamflow is not monitored on most creeks within PRNS. However, the U.S. Geological Survey (1977) has developed regional equations that can be used to produce estimates of flood flows or discharges for several different types of flooding events (e.g., 10 or 100-year flooding event). During winter storm events, stream flow can increase dramatically. The amount of discharge during a storm is dependent upon rainfall rate and soil permeability and saturation levels. The 2-year event is referred to as "bankfull" flow that is identified by geomorphologists as a threshold for channel shaping flows. Because of this return frequency, stream channels often develop features (vegetative and physical) around this bankfull flow. Flood magnitude is often described by estimated return interval, including 5-year, 10-year, 50-year, 100-year, and 500-year floods. The estimates from the regional equations for flood discharge matched reasonably well with observations of hydraulic performance of the culverts during storm events in December 2001 and January 2002 (Table 3.2; NHC 2002). Based on these calculations, hydraulic models were developed to estimate performance under different discharge events. Modeling showed that only one of the culverts (Upper Laguna) is capable of conveying the 100-year peak discharge without overtopping the roadway, and that North Home Ranch is likely to overtop in the 2-year flood discharge.

Table 3.2. Hydrologic Estimates

Site	Basin Area (sq. mi.)	Q_2 (cfs)	Q_{10} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)	Overtop Event [1]
Mount Vision Road	0.8	75	153	237	265	10-Yr

Estero Road	1.6	144	291	447	500	100-Yr
North Home Ranch	0.6	60	124	193	215	2-Yr
Home Ranch	1.6	144	291	447	499	10-Yr
Upper Laguna Creek	1.0	96	196	302	338	100-Yr
Lower Laguna Creek	2.1	186	375	574	641	2-Yr [2]

[1] Hydraulic modeling estimate of overtopping

[2] no overtopping has been observed

3.2.4.2 Water Quality

Riparian and wetland vegetation along streams acts like a buffer and filter for water by intercepting sediment, associated nutrients and contaminants. These compounds are then stored in soils with low or no oxygen or, in the case of nutrients, used for plant growth. This filtering function benefits aquatic organisms and other wildlife within the project area and in Drakes Estero. Water quality is particularly important in this region of coastal California, which supports an aquaculture industry dependent on clean water. Oyster production operations in Drakes Estero and Tomales Bay represent 2 of the 4 permitted growing areas in the state of California. Despite this, oyster harvest is conditional, with closures occurring when rainfall in a 24-hour period exceeds 0.75 inches (CDHS 2003).

While the west Marin coast has generally been perceived as pristine, and has even been used as a "control" site for scientific studies in San Francisco Bay, this region has nonetheless suffered from the anthropogenic impacts of logging, agricultural operations, and leaky septic systems. These water quality problems have prompted the Regional Water Quality Control Board (RWQCB) to declare Tomales Bay and some of its subwatersheds as impaired for sediment, nutrients, pathogens, and mercury under Section 303 (d) of the Clean Water Act. Even within the park, there is potential for water quality problems due to the presence of septic and sewer systems; wildlife and human use of streams, lakes, and bays; and existing dairy and cattle ranches that continue to operate as part of the pastoral landscape within PRNS. Pollution from agricultural operations has been documented and has resulted in the posting of warning signs to discourage recreational use of Kehoe Lagoon.

The RWQCB is the state agency that regulates the federal Clean Water Act, as well as the state of California's Porter-Cologne Act. PRNS falls within the Marin Coastal Basin of the San Francisco District of the RWQCB. This basin includes coastal drainages from Rodeo Creek north to Walker Creek. The RWQCB administers Sections 401 and 402 of the Clean Water Act (CWA), which regulates project-related and point source discharges into regulated water bodies through water quality certification or National Pollutant Discharge Elimination System (NPDES) permits. These federal and state statutes establish the process for regulating waste discharges to land and water. The *Water Quality Control Plan, San Francisco Bay Region* (Basin Plan) establishes beneficial uses for surface and groundwater resources and sets regulatory water quality objectives that are designed to protect those beneficial uses (San Francisco Bay RWQCB 1995). Designated beneficial uses under this Basin Plan include contact and non-contact recreation, cold freshwater fish habitat, agricultural supply, and wildlife habitat. The numeric or narrative quality objectives may be imposed as conditions on waters proposed for discharge to so-called receiving waters such as San Francisco Bay. The Basin Plan establishes different criteria according to the salinity regimes within San Francisco Bay (e.g., Central, South, etc.), but does not specifically develop criteria for water bodies outside San Francisco Bay.

If water bodies do not meet designated water quality objectives and standards for designated beneficial uses, they can be declared impaired under Section 303(d) of the CWA. Once a water body has been declared impaired, the RWQCB must develop a Total Maximum Daily Load (TMDL) program that specifies the allowable load of specified pollutants from individual sources to ensure compliance with water quality standards. This approach differs from the Basin Plan in that it focuses on setting standards for the receiving water rather than the discharged water. Draft TMDLs have been produced for pathogens in Tomales Bay, and the RWQCB has scheduled June 2005 and April 2006 as release dates for preliminary reports on sediment and mercury TMDLs, respectively. Separate TMDLs are being prepared for Lagunitas Creek and Walker Creek, the 2 largest subwatersheds in Tomales Bay. There have been no impairment listings for other waters in or adjoining the Seashore.

In Marin County, the Department of Health Services also monitors water bodies that are used for public recreation during the summer months. It posts closures if monitoring indicates that pollutants are above acceptable levels for recreational contact. Sampling sites include Drakes Beach, adjacent to the Ken Patrick Visitor Center, and the kayak put-in at the head of Schooner Bay (Johnson's Oysters). Beginning in 2000, NPS also began surface water quality monitoring at stream and pond sites within the Seashore to document winter water quality conditions. Implemented in conjunction with fisheries monitoring efforts, the water quality program is focused on identifying water quality impacts to the aquatic ecosystems on NPS-managed lands. Currently, monitoring at 5 sites within the Drakes Estero watershed, as part of the Shellfish Sanitation Monitoring Program, will inform the park on upland contributions to Drakes Estero and water quality.

The Drakes Estero watershed contains both grazed lands and wilderness. Water quality monitoring results reflect the different land uses. Monitoring sites whose watersheds are primarily wilderness have much lower levels of pathogens and nutrients than sites whose watersheds are grazed to some degree (Ketcham 2001). Some of the highest fecal coliform levels in the Drakes Estero watershed were recorded at the Home Ranch monitoring site, downstream of the ranch operation and pastures used by cattle. The mean fecal coliform at the Home Ranch monitoring site (3,047 MPN/100 ml) was an order of magnitude higher than the other Drakes Estero monitoring sites (161 – 430 MPN/100 ml; Ketcham 2001). A maximum level of 9,000 MPN/100ml was observed in April 2001, when there had been no recent storm events that would have increased runoff, and suggesting direct access to the creek by livestock (Ketcham 2001). The Home Ranch exceeded the RWQCB coliform bacteria objectives for non-contact water recreation (mean < 2,000 MPN/100 ml; 90^{th} percentile <4,000 MPN/100 ml), as well as shellfish harvest. Monitored PRNS watersheds, including the Drakes Estero watershed, had total suspended solids (TSS) that exceeded the recommended standard (< 50 mg/L or <100 NTU), regardless of grazing regime (Ketcham 2001). Many areas within PRNS are still recovering from the 1995 Mt. Vision Fire, which initiated movement of large amounts of sediment in some of the watersheds.

3.2.5. Floodplains, Wetlands, and Riparian Zones

Floodplains, wetlands, and riparian habitats are crucial to many watershed functions, such as reduction of flood flow velocity, water quality improvement, food support for aquatic organisms, and wildlife habitat. The value and importance of these functions for both people and wildlife may represent one of the primary reasons that impacts to wetlands and their watersheds have become more closely regulated in recent decades. The U.S. Army Corps of Engineers (Corps) oversees Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act, both of which minimize impacts to navigable waters and special aquatic sites such as wetlands. In addition, wetlands are also regulated under other federal statutes, including Section 401 of the Clean Water Act and the federal Coastal Act, both of which are administered by state agencies – RWQCB and California Coastal Commission (CCC), respectively.

The NPS also scrutinizes projects with potential to impact wetlands in order to comply with an Executive Order #11990 that mandates federal agencies to "...avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct and indirect support of new construction in wetlands wherever there is a practicable alternative..." (Executive Order 11990). In compliance with this executive order, NPS adopted a policy of "no net loss of wetlands", with a long-term goal of a servicewide net gain. Implementation of this policy means that, for new development or new activities, NPS will avoid adverse wetland impacts to the extent practicable, minimize unavoidable impacts, and compensate for other adverse impacts through restoration of degraded wetlands. Unlike Section 404 of the Clean Water Act, adverse impacts under Executive Order 11990 are not only narrowly defined as discharge of dredged or fill material, but include groundwater withdrawals, water diversions, nutrient enrichment, livestock grazing, pumping, flooding, and impounding.

While the RWQCB relies largely upon the Corps and its 1987 methodology to determine Section 401 jurisdiction, the CCC and NPS take a broader, more expansive interpretation of wetlands. As a result, there could be substantially more CCC- and NPS- regulated wetlands than Corps-regulated wetlands within the same project area. Riparian zones often fall into one of these regulatory "gray" zones. Riparian zones

can be defined as "wetlands" by the Corps if they remain wet enough to support hydrophytic plant species and have soils that indicate prolonged ponding or saturation. Typically, young riparian stands often qualify as Corps' "wetlands" and then transition to non-jurisdictional wetlands as sediment deposition raises the elevation and older plants survive by tapping into groundwater tables. The CCC, however, might continue to classify them as wetlands based exclusively on the predominance of hydrophytic species. Ultimately, these disparities in regulatory interpretation reflect jurisdictional differences, not differences in the definition of wetlands.

3.2.5.1 Floodplains

Within the project areas, most of the potential for wetland and riparian habitat remains strongly linked to floodplains and to the hydrologic, geomorphic, and sediment transport processes that create them. Wetlands can establish within creeks themselves, rooting in the creek bed, but this occurs primarily in very low gradient portions of creeks or backwater areas when the scouring forces of flood flows are low. Geomorphologists typically define floodplains as very low elevation plains that are flooded frequently or during bankfull events (e.g., approximately every 2 years). Most of these active floodplains occur within the creek's channel banks. Higher elevation plains outside of the creek's channel banks that are flooded more infrequently are referred to as terraces or abandoned floodplains. However, since these terraces are at least irregularly flooded during larger scale (5 to 50 year) flooding events, they have also been referred to as floodplain terraces. These floodplain terraces often support riparian plant species that are less tolerant of frequent inundation, but still require some connection to a shallow groundwater table for survival. The Federal Emergency Management Authority (FEMA) takes an even broader perspective on flooding, focusing on the 100- and 500-year "floodplains."

While flooding is often viewed as destructive, many wetland and riparian habitats are strongly adapted to it. For riparian habitats in low elevation or topographically flat areas, geomorphic processes, such as meandering, eliminate older habitat through erosion and subsequently allow establishment of pioneering plant species on newly established gravel bars. Some species such as cottonwood (*Populus* sp.) actually require certain flood types (i.e., 5-year or 10-year flood) for successful germination and recruitment. In riparian systems with more complex vegetation communities, larger floods provide the fine sediments that encourage recruitment of species, such as box elder (*Acer negundo*) and Oregon ash (*Fraxinus latifolia*), that are considered characteristic of more mature riparian communities.

Infrastructure such as levees, culverts, and bridges can decrease the potential for floodplains, even in low gradient or topographically flat areas. In higher elevation portions of the Drakes Estero watershed, creek channels are straight and steep, and the floodplains are consequently limited to the active floodplains. However, as the elevation gradient becomes less steep, the channel corridor increases, and so does the potential for larger floodplains and more complicated floodplain systems. Most of the sites in the project area include moderate elevation gradient, with the exception of Lower Laguna, which is located in a very low gradient reach of the stream.

Table 3.3 shows existing floodplain widths for the 2-year and 50- to 100-year flooding events (NHC 2002; Rosgen 1994). Floodplains downstream of the culverts on Mt. Vision Road, Estero Road, and North Home Ranch show incision of the channel bed elevation, thereby increasing the distance between channel and top of bank and disconnecting the creek from its former floodplains. The fact that 50- to 100-year floods would likely be confined to the channel reflects this point. Floodplains upstream at Mt. Vision Road, Estero Road, and North Home Ranch are much wider than downstream floodplains due to sediment accumulation caused by backing up of flood flows behind undersized culverts. Floodplains on Home Ranch Creek would appear to be wide upstream and downstream of the culvert, but the presence of historic structures, including a residence and barns directly adjacent to the creek, disrupts flooding patterns and frequently causes flooding problems for residents and ranch staff. At the Upper Laguna crossing, the channel condition upstream is deeply incised with steep, nearly vertical banks. Downstream of the culvert, the stream opens up to a wide downstream channel corridor with accessible floodplain. The upstream portion of Upper Laguna occurs in a densely vegetated ravine that has been stabilized through placement of a 15-foot high gabion wall to protect the Laguna Trail Road that runs parallel along the creek's northern side (NHC 2002). Floodplains on Lower Laguna, which occurs in a very low gradient or flat section of

Laguna Creek, are wide both upstream and downstream of the culvert. At Lower Laguna, the Coast Trail crosses an active 300-foot wide floodplain with high sediment load and deposition across the valley floor.

Table 3.3 Approximate widths of the 2-year and 50- to 100-year floodplains in the Drakes Estero Watershed Crossing Project Areas (NHC 2002; Rosgen 1994).

	Upstream of Culvert		Downstream of Culvert	
Project Area	2-year Floodplain Width (ft)	50- to 100-year Floodplain Width (ft)	2-year Floodplain Width (ft)	50- to 100-year Floodplain Width (ft)
Mt. Vision	18-20	>60	8-12	~16
Estero Road	25-27	>40	12-16	~28
North Home Ranch	14-21	>44	8-13	~12-20
Home Ranch	30-35	>38	20-30	>56
Upper Laguna	14-15	~18	15-24	~42
Lower Laguna	20-23	>40	35-40	>40

3.2.5.2 Wetlands

Wetlands within the project area principally occur on active floodplains or floodplain terraces, vegetated swales, drainages, or gullies flowing into the creeks, and depressional features adjacent to creeks. In addition to creek surface flow and precipitation, hydrologic sources for these creeks include small, sometimes eroded drainages that convey surface run-off from adjacent roads, hillsides, and seeps. Based on the Cowardin wetlands classification system developed by the U.S. Fish and Wildlife Service (USFWS), most of the wetlands are palustrine or freshwater and dominated by forests or shrubs with an understory of wetland-dependent plant species (Cowardin et al. 1979, Parsons 2003). Some of the dominant understory wetland plant species present in forested or shrub areas are: juvenile arroyo willow (*Salix lasiolepis*), stinging nettle (*Urtica dioica*), and water parsley (*Oenanthe sarmentosa*). There are also several wetland features that support only herbs, forbs or smaller plant species. Dominant species in these areas include: annual bluegrass (*Poa annua*), toad rush (*Juncus bufonius*), water parsley, western mannagrass (*Glyceria occidentalis*), pennyroyal (*Mentha pulegium*), rush (*Juncus effusus* and *J. phaceophalus* var. *phaeocephalus*), and sedge (*Scirpus microcarpus*, OBL).

To comply with federal regulations, 3 separate wetland delineations were performed to determine areas subject to the jurisdiction of the Corps, CCC, and NPS.

Corps Jurisdiction. The Corps regulates several types of activities in United States waters, which include navigable waters, tributaries to navigable waters, special aquatic sites (e.g., wetlands), and areas that are "adjacent" to navigable waters. These waters are regulated under Section 404 of the Clean Water Act (40 CFR Section 328.3) or Section 10 of the Rivers and Harbors Act (33 U.S.C. 403). A wetland delineation was performed at the 6 sites and verified by the Corps on November 12, 2002 (Parsons 2002). Acreage of wetland habitat within the project sites are shown in Table 3.4. There are no jurisdictional tidal waters, tidal wetlands or Section 10 waters present in the project areas. Jurisdictional non-tidal waters were mapped within the 6 project sites and typically include portions of the creek and drainages or tributaries to these creeks. There are no vegetated areas (vegetation cover > 5 %) below the Ordinary High Water (OHW) mark in the delineated creeks. Jurisdictional adjacent wetlands consist of vegetated drainages or tributaries, and swales adjacent to creeks that showed some evidence of connectivity, typically hydrologic.

Table 3.4 Acreage of jurisdictional Section 404 wetlands and waters.

	Waters		Wetlands		
	Tidal	***Non-Tidal***	***Tidal***	***Non-Tidal***	***Adjacent***
Mt. Vision	0.000	0.110	0.00	0.003	0.000
Estero Road	0.000	0.070	0.00	0.000	0.012
North Home Ranch	0.000	0.040	0.00	0.000	0.018
Home Ranch	0.000	0.030	0.00	0.000	0.008
Upper Laguna	0.000	0.100	0.00	0.000	0.000

Lower Laguna	0.000	0.140	0.00	0.000	0.673

CCC Jurisdiction. Within California, the CCC administers the state program (California Coastal Act) for implementation of the federal Coastal Zone Management Act (CZMA). Actions by federal agencies, such as NPS, require a federal consistency determination by the CCC as required by CZMA. The CCC reviews proposed wetland development projects within the California coastal zone. In the coastal zone, the CCC, with assistance from CDFG, is responsible for determining the presence and size of wetlands subject to regulation under the California Coastal Act (CCC 2002). The CCC has adopted the CDFG wetland definition and classification system. A wetland delineation using this method was performed at the 6 (Parsons 2003). Four of the 6 project areas appear to fall within the Coastal Zone, specifically Home Ranch, North Home Ranch, Estero Road, and Lower Laguna. Table 3.6 presents a list of project areas and acreage of wetlands delineated within these areas that are potentially subject to regulatory oversight by the CCC. Because the CCC takes a broader interpretation of wetlands relative to its regulatory oversight, wetland areas potentially subject to CCC jurisdiction are larger than those subject to Corps' jurisdiction.

NPS Oversight. Director's Order #77-1 established NPS policies, requirements, and standards for implementing Executive Order 11990, which directs federal agencies to avoid long- and short-term impacts to wetlands. NPS uses the Cowardin classification system as the basis for creating a standard for defining, classifying, and inventorying wetlands that might be subject to adverse impacts and NPS oversight (Cowardin et al. 1979). Table 3.5 presents a list of the project areas and wetland acreages within those areas that would appear to be subject to Executive Order 11990.

Table 3.5. Area (acres) of wetlands delineated and classified in the Coastal Watershed Stream Restoration Program Culvert Replacement Project Delineation Study Area potentially subject to Executive Order 11990.

	Palustrine																					
		Forested Wetlands							Scrub-Shrub Wetlands									Emergent Wetlands					
Site	PUB3H	PFO1C	PFO1E	PFO1F	PFO1H	PFO1D	PFO1X	PFO1Yh	PSS1F	PSS1H	PSS1J	PSS1X	PSS3A	PSS3E	PSS3X	PSS10H	PSS10X	PEM1E	PEM1F	PEM1/2E	PEM2A	PEM2E	Total Acreage
Lower Home Ranch	0.024															0.010	0.031					0.008	0.073
Upper Home Ranch					0.018		0.161			0.019	0.102									0.018			0.318
Estero Road				0.002	0.071		0.015		0.001			0.134	0.012		0.071				0.001		0.010		0.317
Mt. Vision Road	0.058		0.001		0.049		0.530							0.004	0.139			0.001					0.782
Upper Laguna					0.098		0.763																0.861
Lower Laguna		0.004			0.141	0.638		0.035															0.818

Table 3.6. Area (acres) of wetlands delineated and classified in the Coastal Watershed Restoration Program Culvert Replacement Project Delineation Study Area subject to potential regulatory oversight by the California Coastal Commission.

	Palustrine																					
		Forested Wetlands							Scrub-Shrub Wetlands									Emergent Wetlands					
Site	PUB3H	PFO1C	PFO1E	PFO1F	PFO1H	PFO1D	PFO1X	PFO1Yh	PSS1F	PSS1H	PSS1J	PSS1X	PSS3A	PSS3E	PSS3X	PSS10H	PSS10X	PEM1E	PEM1F	PEM1/2E	PEM2A	PEM2E	Total Acreage
Lower Home Ranch	0.024															0.010	0.031					0.008	0.073
Upper Home Ranch					0.018		0.161			0.019	0.102									0.018			0.318
Estero Road				0.002	0.071		0.015		0.001			0.134	0.012		0.071				0.001		0.010		0.317
Lower Laguna		0.004			0.141	0.638		0.035															0.818

Wetland Invasive Plant Species. Of the non-native species specifically present in wetlands, only two would be considered potentially invasive, pennyroyal and common velvet grass (*Holcus lanatus*). Exotic or invasive species are defined as those ranked by the California Invasive Plant Council (CalIPC) or by PRNS as a threat to native ecosystems of California and/or the park. CalIPC relies on a categorical system to rank the risk posed by invasive species, from the most invasive species in List A, to the least invasive, listed as "Considered But Not Listed". The most recent version of this system dates to October 1999, although CalIPC is updating the list. PRNS has been making extensive efforts to remove species that it considers invasive or a specific threat to park ecosystems, many of which also appear on the CalIPC list. One of the species that the Seashore has been targeting is pampas grass (*Cortaderia selloana*), which occurs in wetlands.

Pennyroyal is listed by CalIPC as a List A-2 species and is one of the most invasive plant species in the region. Within the project areas, pennyroyal was almost exclusively observed in emergent wetlands or wetlands with no forested or shrub overstory canopy. Common velvet grass is listed as a species of lesser invasiveness (List B). However, within PRNS, this species has spread dramatically, particularly in coastal prairies near the ocean and in former ranching areas that are no longer grazed. While this species can occur in wetlands, the moist microclimate in PRNS allows it to colonize upland as well as wetland communities. The extent of this species within project sites is relatively small.

3.2.5.3 Riparian

Unlike riparian communities along larger waterways, smaller drainages in coastal Marin county do not undergo classical riparian successional patterns in which pioneering species are established and later replaced by late successional species. In general, vegetation patterns along most of the smaller creeks in Marin County appear to be dictated more by stream and valley slope gradients than successional patterns. Moderate to high-gradient drainages in Marin often support a riparian overstory community composed of California bay (*Umbellularia californica*), coast live oak (*Quercus agrifolia*), California buckeye (*Aesculus californica*), and, in coastal areas, Douglas fir (*Pseudotsuga menziesii*) and redwood (*Sequoia sempervirens*). Where bank slope and substrate conditions permit, red alder (*Alnus rubra*) often lines the banks of moderate to high-gradient creeks.

As drainages and creeks flow down into moderate and low gradient areas, the vegetation community shifts dramatically. Species such as California bay and coast live oak disappear from the riparian zone, although they may persist in forested areas adjacent to riparian areas. Instead, the riparian habitat is dominated by fast-growing, pioneering species, such as arroyo willow and red alder, that often grow in almost impenetrable thickets. While shrub-dominated riparian habitats can represent immature or developing tree communities, even mature trees often never exceed 60 feet. This stunting could result from species characteristics or from persistent disturbance factors such as heavy flooding, grazing ("pruning" by cattle), or repeated sedimentation events.

The project area creeks universally support a broad-leaved deciduous riparian overstory comprised predominantly of red alder with some arroyo willow. Acreage of riparian habitats within each project area are shown in Table 3.7. Common understory species include: California blackberry (*Rubus ursinus*), salmonberry (*Rubus spectabilis*), thimbleberry (*Rubus parviflorus*), red elderberry (*Sambucus racemosa*), California man-root (*Marah fabaceus*), stinging nettle, California figwort (*Scrophularia californica*), and water parsley. These understory species are often dominant on the smaller drainages and gullies. The exception to this is the Home Ranch project area, which, because of its proximity to the ranch facilities, has not developed a riparian overstory upstream of the ranch road crossing.

The Home Ranch project area supports the least amount of riparian vegetation (0.04 acres) and the riparian community present is characterized by a number of non-native ornamental species such as fig and holly. The largest amount of riparian habitat occurs at the Upper Laguna, Lower Laguna, and Mt. Vision Road sites. Wider floodplains at these sites appear to promote colonization of riparian species. Riparian habitat is relatively sparse downstream of the Estero Road crossing, possibly due to downcutting of the streambed and disconnection with the floodplain terrace. At North Home Ranch, grazing, channel maintenance, and small floodplains may have acted to reduce the amount of riparian habitat downstream of the crossing.

Table 3.7 Acreage of riparian habitat in the Drakes Estero Watershed Crossing Project.

Project Area	Forested Riparian	Shrub Riparian	Total Riparian
Mt. Vision	0.58	0.143	0.723
Estero Road	0.088	0.218	0.306
North Home Ranch	0.179	0.121	0.300
Home Ranch	None	0.041	0.041
Upper Laguna	0.861	None	0.861
Lower Laguna	0.818	None	0.818

Riparian Invasive Plant Species. There were no invasive non-native species present in riparian habitat.

3.2.6. Wildlife

One of the most important functions of watersheds is to provide habitat for wildlife species. Some species use creeks, wetlands, and riparian habitat seasonally for breeding or spawning, foraging, refugia, or as a migration corridor. Other species are residents that spend their entire lives within these systems. Adult steelhead trout and coho salmon leave ocean waters to migrate into the upper portions of watersheds to spawn and eventually die, while juveniles spending an extended period (1-3 years) maturing in these creeks before migrating to the ocean. PRNS riparian habitat is also important for breeding neotropical migrant bird species during the spring, and many areas are protected under the Migratory Bird Treaty Act of 1918. California red-legged frogs (*Rana aurora draytonii*) breed, hatch and metamorphose in freshwater marshes during the spring and can move into riparian habitat in the summer. Watersheds play an important role for common wildlife species such as the Pacific giant salamander (*Dicamptodon tenebrus*), California newt (*Taricha torosa*), and wood rat (*Neotoma fuscipes*). Terrestrial animals such as bobcat (*Felis rufus*) and racoons (*Procyon lotor*) often use unfragmented or continuous riparian habitat as migration corridors.

Most of the project sites occur in Pastoral Landscape Management Zones (Home Ranch, North Home Ranch, Estero Road, Mt. Vision Road) and, therefore, support a slightly lower diversity of wildlife species than sites in Natural Landscape Management Zones (Upper Laguna, Lower Laguna). However, while dairy and beef cattle operations potentially decrease the amount and/or quality of riparian and wetland habitat within grazed watersheds, pastoral areas still provide important habitat for a number of common and special status wildlife species.

The presence of roads adjacent to creeks may play a more important role in decreasing the quality of wildlife habitat.

3.2.7 Special Status Species, Critical Habitat, and Essential Fish Habitat

A determination of Special Status Species with potential to occur 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 (July 21, 2004).
- Evens, J. G. 1993. The natural history of the Point Reyes Peninsula. Point Reyes National Seashore Association, Point Reyes Station, CA.
- Point Reyes National Seashore rare plant database (PRNS 2003).
- Point Reyes National Seashore plant list database (PRNS 2003).
- California Native Plant Society (CNPS). 2001. Inventory of rare and endangered plants of California. Sixth Edition.

The determination was based on consideration of known species ranges, minimum habitat requirements, occurrence of required habitat within the project area, and historical sightings at Point Reyes. Included for

review are species listed 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 (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 conducted as part of the planning process included amphibian surveys (Fellers and Guscio 2002), salmonid assessment (NPS unpublished data), and site rare plant surveys (Parsons and Allen 2003). The presence of neotropical migrant breeding birds in the Drakes Estero watershed has been documented previously by studies conducted by Point Reyes Bird Observatory (PRBO) (Toniolo and Gardali 2002).

3.2.2.1 Special Status Fish Species.

Special status fish species potentially within the project areas are central California coast Evolutionarily Significant Unit (ESU) steelhead trout (*Oncorhynchus mykiss*; federally Threatened) and central California coast coho salmon (*Oncorhynchus kisutch*; federally Threatened). Other species such as tidewater goby (*Eucyclogobius newberryi*; federally Endangered) are restricted to brackish portions of watersheds, typically in tidal embayments and lagoons.

Most of the project area streams, including East Schooner, Home Ranch, and Laguna Creek, support steelhead. The adults typically spawn in gravel riffles in the spring, from January - April. Unlike coho salmon, steelhead adults can return to creeks for multiple years to spawn before dying. Steelhead fry or newly hatched fish emerge to low energy habitat areas. Older steelhead juveniles tend to use riffles and pool margins, potentially overlapping with California red-legged frog tadpoles. The juveniles spend 1-2 years in creeks before migrating out to the ocean. Because of dramatic declines in population numbers, NOAA Fisheries listed Central California Coast steelhead as threatened in 1997 (Federal Register 1997).

North Home Ranch Creek is the only project area creek that does not have substantial spawning and summer rearing habitat for anadromous species. Steelhead have not been observed in this creek. Fisheries assessments have been conducted in the project watersheds in 1984 (Self and Ranlett) and 1997 (Cappellini and Everly), and steelhead were documented during these surveys. While historic accounts describe adult steelhead in many of the project watersheds, only recent anecdotal accounts have described steelhead in East Schooner Creek. NPS conducted fish sampling in November 2002 at East Schooner, Home Ranch, North Home Ranch, and Laguna Creeks. No coho salmon were trapped, but steelhead young of year (<1 year old) and 1-year+ aged fish were caught at Mt. Vision Road, Estero Road, Home Ranch, Upper Laguna, and Lower Laguna (NPS, unpublished data). Other fish species caught in project area creeks included sculpin (*Scorpaena guttata*) and threespine stickleback (*Gasterosteus aculeatus*). No fish were caught or observed in North Home Ranch Creek.

Coastal watersheds along the central California coast, from Punta Gorda to Santa Cruz County, have also been designated as Critical Habitat for coho salmon as part of the central California coast ESU. The Seashore and adjoining areas are also included in Essential Fish Habitat for coho salmon as part of Magnuson-Stevens Fishery Conservation and Management Act. Critical habitat for central California coast steelhead is currently being formulated.

3.2.2.2 Special Status Amphibian and Reptile Species

Special status amphibian and special status reptile species potentially living within the project area include California red-legged frog (*Rana aurora draytonii*; federally Threatened) and northwestern pond turtles *(Clemmys marmorata mormorata*; federal Species of Concern). Of these, only the California red-legged frog (CRLF) was observed during comprehensive surveys. Frogs were found within 400 m of all the project sites except for Mt. Vision Road Crossing, though none were actually documented within the project construction areas. The project areas occur in active stream channels, considered non-breeding habitat for the red-legged frog. Fellers and Guscio concluded that the 6 sites have habitat that supports the

CRLF in or near the project areas (Fellers and Guscio 2002). "If the restoration projects consist of replacing existing creek crossing structures and a minimal amount of habitat disturbance, the impact on frogs is likely to be small" (Fellers and Guscio 2002).

The red-legged frog was once abundant throughout California, but is absent from more than 70% of its original range. The largest known populations of red-legged frog are at PRNS, where there are more than 120 breeding sites with a total adult population of several thousand frogs. Peak egg-laying by CRLF occurs in January within slow moving or static water systems, primarily artificial stock ponds used for cattle watering (Fellers and Guscio 2002). Red-legged frogs need still water ponds or pools for breeding from December through March. While some frogs occupy breeding ponds throughout the year, data on red-legged frogs at PRNS and elsewhere suggest that riparian areas provide critically important non-breeding habitat for many individuals, especially those that breed in non-permanent ponds or pools (Fellers and Guscio 2002). Riparian habitat may also be used as breeding habitat in dry years (Fellers and Guscio 2002).

The project area falls within a region of California that was proposed as Critical Habitat for the red-legged frog in 2001. PRNS is within the Point Reyes Critical Habitat Unit (Unit 12), which consists of "watersheds within and adjacent to Bolinas Lagoon, Point Reyes, and Tomales Bay in Marin and Sonoma counties" and "contains one of the largest known populations of California red-legged frogs" (USFWS 2001). However, a federal court ruling in fall 2002 required the US Fish & Wildlife Service (USFWS) to review the economic analysis performed for the red-legged frog Critical Habitat designation, and the designation remains in proposal form. For the purposes of this EA, Critical Habitat for red-legged frog is treated as a proposed designation.

No pond turtles were documented at the project sites (Fellers and Guscio 2002).

3.2.7.4 Special Status Invertebrate Species

Potential special status invertebrate special status species within the project areas include California freshwater shrimp (*Syncaris pacifica*; federally Endangered) and Myrtle's silverspot butterfly (*Speyeria zerene myrtleae*; federally endangered).

No California freshwater shrimp were found in the project watersheds (Lo Bianco and Fong 2003).

Although individuals of the federally Endangered Myrtle's silverspot butterfly (*Speyeria zerene myrtleae*) have not been documented within the project areas, their larval food plant, hooked spur violet (*Viola adunca*), occurs within the Drakes Estero watershed. This plant species was not observed within the project areas.

3.2.7.5 Special Status Avian Species

Potential occurrence of special status avian species would include neotropical migrants that breed in riparian habitat. No special status avian species have been observed in the project areas. Songbird surveys were conducted in 2002 in riparian areas adjacent to some project sites (Estero Road, North Home Ranch), but no special status species were observed. Species observed included house finch (*Carpodacus mexicanus*), savannah sparrow (*Passerculus sandwichensis*), western bluebird (*Sialia mexicana*).

None of the project sites are within 0.25 miles of known breeding locations for the northern spotted owl (*Strix occidentalis caurina*).

3.2.7.6 Special Status Mammal Species

Special status mammal species potentially occurring within the project areas included the Pt. Reyes mountain beaver (*Aplodontia rufa phaea;* federal Species of Concern), which is not listed, but considered a Species of Concern by the USFWS. This subspecies of the common mountain beaver is only known to occur in Marin County, and its range is almost entirely within PRNS. The Point Reyes mountain beaver inhabits moderately dense coastal scrub habitat in colluvial hollows. Although PRNS staff have not conducted formal mammal inventories as part of this planning process, mountain beaver have not been observed in the vicinity of the project sites.

3.2.7.7 Special Status Plant Species

Of the 81 plant species with potential to occur in the general vicinity of the project areas, none have the potential to occur within the project area wetlands, nor were individuals sighted during reconnaissance and subsequent field surveys (Parsons and Allen 2003). Sonoma alopecurus (*Alopecurus aequalis* var. *sonomensis*) is described in the literature as occurring in freshwater marshes. However project area conditions do not appear conducive to establishment of this species, which has primarily been observed on the fringes of large freshwater marshes within PRNS.

3.2.8 Cultural Resources

The Seashore's history of Native American settlement, European exploration, and eventual colonization by Spaniards and Americans left it a legacy of important archeological and historic resources. NPS 28m the National Park Service Cultural Resources Management Guidelines (NPS 1998) recognizes 5 types of cultural resources: archeological resources, historic structures, ethnographic resources, cultural landscapes, and museum objects as defined in. Archeological resources are "the remains of past human activity and records documenting the scientific analysis of these remains." These include artifacts, ecofacts, and features. Structures are "material assemblies that extend the limits of human capacity," and comprise such diverse objects as buildings, bridges, vehicles, monuments, vessels, fences, and canals. Ethnographic resources "are basic expressions of human culture and the basis for continuity of cultural systems" and encompasses both the tangible (native languages, subsistence activities) and intangible (oral traditions, religious beliefs). Cultural landscapes "are settings we have created in the natural world." Finally, museum objects "are manifestations and records of behavior and ideas that span the breadth of human experience and depth of natural history." Examples of typical museum objects include field and laboratory notes, artifacts, and photographs.

Archeological Resources. At least 124 Native American archeological sites exist within PRNS, primarily on the coastal lowlands. These known prehistoric sites are primarily shell middens, voluminous deposits of rich organic soil with a relatively high content of local shell, created by human habitation of the site. The park also has 92 historic terrestrial archeological sites. These sites typically reflect historic occupation and use of the peninsula, first by homesteaders and dairy ranch communities, and later by government lighthouse and lifesaving personnel and private radio telecommunications companies. They include discrete trash pits containing old bottles, tins, broken tools and crockery, buried corduroy roads, ruined ranch sites, and radio communication facilities.

More than 87% of PRNS lands have not been surveyed for archeological resources, mostly because of thick vegetation and rugged topography.

As part of the project planning, field surveys were conducted in conjunction with a record search at the Northwest Information Center (NWIC) of the California Historical Resources Information System (Rohnert Park, Calif, Newland 2004). There were no records of past archeological finds, and no archeological resources were found within the project areas (Newland 2004).

Tribal Lands. The recently completed Point Reyes National Seashore Cultural Affiliation Report (Emberson et. al. 1999) examining Native American affiliation at Point Reyes concluded that the Federated Coast Miwok people have a clear, exclusive affiliation with the lands managed by Point Reyes National Seashore extending back more than 2,000 years. The Federated Coast Miwok are politically recognized by the federal government as the Federated Indians of Graton Rancheria.

Cultural Landscapes. PRNS manages 39 cultural landscapes; 23 are within the boundaries of PRNS, and 16 are within the North District of the GGNRA. The landscapes primarily reflect the maritime, ranching, communications, and military history of the park. Two are ranching districts, which together comprise approximately 30,000 acres of parkland in the northern district of Point Reyes and the Olema Valley. Two other landscapes have national significance: the Lifeboat Station is a National Landmark and the Marconi/RCA sites are in the process of being nominated to the National Register. Home Ranch [CLAIMS

725006] (Cultural Landscapes Automated Information Management System) is listed as a feature integral to the Point Reyes Ranches Historic District Cultural Landscape CLAIMS # 725005). Home Ranch is one of the oldest and best preserved ranches on the Point Reyes Peninsula (Livingston 1994).

Structures. More than 300 hundred historic structures are found on land managed by PRNS. The structures range from simple timber-framed barns to the cast-iron Point Reyes Lighthouse to the concrete Mission Revival Marconi transmitting station. Historic structures are found throughout most of the park (with none in the wilderness area) and mark the built history of PRNS. Approximately two thirds of the Seashore's listed structures are ranch structures managed under leases and permits. The remaining structures reflect the park's maritime and radio communication history. Four sites are listed in the National Register, including the Point Reyes Lifeboat Station, a National Historic Landmark. Three additional properties have been determined to be eligible for the National Register and several additional properties are in review. Two hundred ninety-seven historic structures are on the List of Classified Structures, the NPS inventory of historic and prehistoric structures. At least one of these structures occurs in the Drakes Estero Watershed.

A 1918 map shows a building near Estero Road, but no evidence was found of it during project surveys (Newland 2004). A 1954 map also shows a building north of the North Home Ranch project site (Newland 2004). During the 2004 surveys, what is possibly a building pad was observed as a small, grassy flat cut on an east-facing slope, approximately 67 feet north of the project site. In addition, 2 rusted iron pipes, each approximaely 4-6 inches in diameter, were seen protruding from the creek bank and appear to lead to this pad (Newland 2004). At Upper Laguna, the remains of what appeared to be a bridge crossing was found: it consists of 3 wooden timbers set into the creek bottom and may have served as a support for a bridge that has since been removed. Segments of concrete were also seen buried in blackberry brush on the north bank of a small gully that flows into the creek (Newland 2004). None of the other project areas showed signs of historic structures (Newland 2004). While Home Ranch is considered historic, the crossing structure itself is an arch metal culvert installed following the 1982 flood events (B. Ketcham, pers. comm. in Newland 2004).

3.2.9 Recreational Resources, Visitor Experience, and Aesthetic Resources

National parks are valued for the recreational and aesthetic resources they provide to the public. While many parks primarily serve visitors who come from outside the park's region, the majority of the 2.5 million visitors who come to PRNS each year live in the San Francisco Bay area. Park visitors expect national parks to provide beauty, a sense of quiet, and opportunities for hiking, bird-watching, and other recreational pursuits. 2002 estimates show that the North District of the park, where Drakes Estero Watershed is located, receives approximately 60% of the overall park visitation. In 2002, more than 700,000 visitors visited the 3 park visitor centers, and more than 70,000 visitors had extended contacts with park interpretive staff through ranger-led programs.

PRNS provides backcountry campgrounds, numerous beaches, and 147 miles of hiking trails. Activities include hiking, water sports, horseback riding, fishing, camping, wildlife viewing, and other interpretive opportunities. Hiking is primarily a day-use activity. There are approximately 50 trails throughout PRNS, and they are found in a range of habitat types, ranging from wooded mountains to sandy beaches. Overnight stays are possible in 4 backcountry campgrounds, the Stewart Horse Camp, the Point Reyes Hostel, a private campground, and local hotels and inns. Visitors bring horses daily to ride on designated trails, and hundreds rent horses every week from commercial stables. Water sports include kayaking, canoeing, boating, and swimming.

NPS gathers standardized annual surveys for each park unit to determine visitor satisfaction based on park facilities, visitor services, and recreational opportunities. During October 2001- September 2002, based on a random visitor survey conducted by the University of Idaho, the park received a 98% visitor satisfaction ranking (NPS 2002).

Of the 6 project sites, 4 are integral to PRNS hiking and/or biking trails, providing important linkages. Estero Road provides access to the Estero Trailhead, as well as the Home Ranch facility. The crossing of East Schooner Creek is not necessarily part of the trail system itself or part of the aesthetic resources of the trail system. Portions of the Estero trail network are open to bicyclists. The trail network is very popular year-round with birdwatchers and hikers. More than 17,481 people visited the Estero Trail between January – May 2004 (NPS, unpublished data). Kayaks put into the Estero from the area near Johnson's Oyster Farm. However, in general, the trail network in the Drakes Estero watershed does not receive high numbers of visitors according to monthly visitation counts. North Home Ranch and Home Ranch, which are accessed via Estero Road, are not open to the public and provide access only to NPS staff, Home Ranch residents and staff.

Mt. Vision Road climbs up the ridge, affords dramatic views of the coast and bay, and provides access to the Inverness Ridge and Bucklin Trails. The Bucklin and Inverness Ridge Trails can also be accessed from the Muddy Hollow Trail and Limantour Road, respectively. Mt. Vision had more than 244,740 visitors between January and May 2004, much higher numbers than Estero Trail.

Upper Laguna provides access to the Laguna Trail trailhead, which can also be reached from further east on Limantour Road. The Upper Laguna crossing is near the parking area for the trailhead, but is not necessarily part of the trail system or its aesthetic resources. Lower Laguna falls along the Coast Trail to Coast Camp and allows access for both hikers and bikers and for NPS staff maintaining Coast Camp. Coast Camp can also be accessed by the Laguna and Fire lane trails, but does not allow bikes. One of the more visually appealing elements of the Coast Trail is the large riparian forest along Laguna Creek, which parallels the trail for some distance. The crossing takes visitors through the riparian habitat, providing shade on hotter days.

3.2.10 Public Safety and Transportation

PRNS is unusual in that it is not only a national park, but is also home to beef and dairy ranches and directly adjoins private commercial and residential properties. Local community members access their homes and businesses using the same main park and county-managed thoroughfares as park visitors, principally Bear Valley Road, Sir Francis Drake Boulevard, and Limantour Road. The fact that PRNS is used by both park visitors and local community members increases the complexity of managing public safety. Public safety concerns within PRNS include: vehicular accidents, infrastructure failures, flooding, fire, wildlife, unusual environmental conditions (e.g., riptides), disease vectors such as mosquitoes and ticks, and human accidents (e.g., falls, drownings, boating accidents).

Marin County has defined transportation in unincorporated areas of the county, including PRNS, as being Level of Service D. This designation describes traffic that is approaching an unstable condition, with rapidly developing queues, but little delay for motorists (County of Marin 1994). Within PRNS, Bear Valley Road connects Highway 1 with Sir Francis Drake Boulevard and provides access to park administrative headquarters and Limantour Road, the main road leading to the Upper and Lower Laguna project areas. Bear Valley Road and Sir Francis Drake Boulevard are county roads that are heavily used by residents of Inverness Park, Inverness, and residents and staff of dairy and beef cattle ranches on Point Reyes Peninsula. Besides visitors, NPS employees use Limantour Road to reach park housing in the vicinity. The transportation element of the General Plan notes that regionally important recreational uses have caused unexpected congestion on certain West Marin routes, including Sir Francis Drake Boulevard.

Emergency services access the project areas from Bear Valley Road, Limantour Road, and Sir Francis Drake Boulevard. NPS maintains a fire crew based at the Hagmaier complex 5 miles south of Olema. NPS law enforcement staff provides resource protection and initial response to most medical and traffic-related emergencies on federal lands. Depending on the need and location, federal, state, county, and local fire agencies respond to calls within PRNS. Marin County maintains primary fire and EMT services based in Point Reyes Station. The area is also served by local emergency and fire response through the Inverness Public Utilities District.

Relative to urban areas, the amount of transportation infrastructure in the project area is minimal. From Sir Francis Drake Boulevard, residents and staff of Home Ranch use Estero Road to access the ranch, crossing the Estero Road and North Home Ranch crossings. There are no other vehicular access roads to Home Ranch. PRNS employees also use these crossings to access Home Ranch and Seashore lands west of Home Ranch. Mt. Vision Road provides the only vehicular access to 2 NPS staff residences and a FAA transponder site. Upper Laguna provides the only vehicular access to two other NPS staff residences.

4.0 Environmental Consequences

4.1 Methods of Analysis

NEPA requires that an Environmental Assessment 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 each alternative on geological resources, water resources, wildlife, vegetation, special status species, and cultural resources. It also identifies mitigation strategies that would be implemented to avoid or reduce adverse effects.

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 environmental documents. The following definitions are used to evaluate the project alternatives:

4.1.1 Analysis of Incremental Effects

Incremental effects refer to the effects specific to a particular proposed action or activity, independent of other activities taking place at PRNS. Consistent with NEPA requirements, the analysis in this chapter considers the context, intensity, and duration of the potential incremental effects.

Context describes the setting within which effects are analyzed. In this environmental assessment the intensity of impacts are evaluated within a local (**project area**) context, only 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. In this analysis impacts are identified as *beneficial* or *adverse*; beneficial impacts would improve resource condition or visitor experience, while adverse impacts would effect these negatively. The intensity of an impact may be **Negligible, Minor**, **Moderate**, or **Major.** The intensity of impacts is described for each impact topic within Section 4.2 below.

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**. Short-term typically describes effects that are limited to the construction window and period immediately following, while long-term effects may persist for years following project completion. Additional information pertaining to specific impact topics is described, when necessary, in Section 4.2 below.

Type of Impact is a description of whether impacts resulting from an alternative would be **Beneficial** or **Adverse**. Beneficial impacts would improve resource condition or visitor experience, while adverse impacts would affect these negatively.

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 resident or migratory fish or wildlife species to move.
- Cause measurable changes in species composition or abundance of a special status community.
- Cause change directly or indirectly to the stability of slopes or erodability 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 or visitor experience 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 viewsheds in the project area.

4.1.2 Analysis of Cumulative Impacts

NEPA requires federal agencies to analyze the potential of their proposed actions to contribute to cumulative effects identified in the project region. A cumulative effects is ". . . the effect 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 § 1508.7). A significant impact may exist if an action is related to other actions that have individually insignificant but cumulative effects. The discussion of potential cumulative effects is included in the discussion of each impact topic. Overall discussion of cumulative impacts for the each project alternative, by impact topic, is found in Section 4.2

Because cumulative effects refers to a combined effect, there is no cumulative effect on a resource unless more than one action affects that resource, or a single action or activity results in repeated but discrete effects on the resource. Accordingly, a first step is to identify other projects that may cause cumulative effects with the actions proposed in this Environmental Assessment. For most resources considered in this document the area of analysis for cumulative effects is the Drakes Bay watershed, with the exception of effects on air quality, which were analyzed for the watershed and adjacent downwind portions of the San Francisco Bay Area Air Basin. The analysis included actions slated for implementation within the next 5 years. These actions are listed in Table 4.1 below.

Table 4.1 Related Actions for Cumulative Impact Analysis

Action	Overview
Coastal Watershed Project – Geomorphic Restoration	This project seeks to improve hydrologic conditions at 3 sites in the Drakes Bay Watershed by restoring pre-disturbance geomorphology. It proposes earth-moving activities at 2 water impoundment sites and at road crossings. The purpose of the project is to reduce long-term maintenance obligations, and create more sustainable ecological systems based on physical and hydrologic stability.
Horseshoe Pond Restoration	This action entails the removal of spillway and dam materials to restore natural hydrologic and shoreline processes to a 35-acre area immediately west of the mouth of Drake's Estero. It will also restore or enhance the access road, borrow quarry, and former waste lagoon to more natural conditions. It is scheduled to be implemented by fall 2004, and will require state and federal permits similar to those required for the proposed action.
Giacomini Wetlands Restoration Project	PRNS and Golden Gate National Recreation Area (GGNRA) are conducting a large-scale wetland restoration project at the southern end of Tomales Bay. This project would restore natural hydrologic and ecological processes and functions to the historic tidal marsh, which was leveed in the 1940s for operation of a dairy ranch. The project is currently in the alternatives development phase. A draft EIS/Environmental Impact Report (EIR) is scheduled for 2005, with

	possible implementation of a portion of the project in late 2006.
Glenbrook Dam and Quarry Restoration Project	This action entails the removal of dam remains and restoration of the borrow areas at the mouth of Glenbrook Creek in the Estero de Limantour. The project completion is scheduled for fall 2005. It will require a number of state and federal permits as well as minimum tool clearance for operations within a designated Wilderness area.
Dune Restoration Project	This action entails the removal of non-native European beach grass from the dune areas within the Seashore. Removal methods and restoration strategies are currently being tested near Abbott's Lagoon, and will be employed at a larger scale during 2007.
Fire Management Plan	NPS has completed a Fire Management Plan for the Seashore and is conducting an environmental analysis of program alternatives. The preferred alternative would result in prescribed fire and mechanical treatment of no more than 3,000 acres per year within identified fire management units (FMUs). While 27% of the Drakes Bay watershed is included in active treatment FMUs under the plan, the NPS does not anticipate treatment in more than 10% of any one subwatershed with in the larger Drakes Bay watershed within any one year. The draft environmental impact statement for the Fire Management Plan is now in public review. The NPS anticipated implementation beginning in FY2005.

4.1.3 Impairment of Park Resources

NPS Management Policies (NPS 2001) 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. An impairment 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." In general, an impact is more likely to constitute an impairment if it affects a resource or value whose conservation is necessary to specific purposes identified in the legislation or proclamation that created the park unit; one that is essential to the park's natural or cultural integrity, or to the public's opportunities to enjoy a park; or one that is specifically identified as a goal in the park's General Management Plan or other relevant NPS planning documents.

At PRNS, the park resources and values that are the focus of the no-impairment standard include the ecological, biological, and physical processes that created the park and continue to act upon it, as well as the cultural resources that reflect the region's legacy of Native American use. With these resources in mind, analysis of incremental effects considered the proposed actions' potential to impair the natural and cultural resources of Point Reyes National Seashore.

4.2 Impact Analysis by Topic

4.2.1 Effects Related to Geology, Geologic Hazards, and Soils

4.2.1.1 Policies and Regulations

A variety of federal, state, and local regulations relate to Geology, Geologic Hazards, and Soils. These are described briefly in this section.

Federal Guidance. 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 § 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 Order #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.

As the project areas fall within the California Coastal Zone, defined as lands within one mile of the California Coast, PRNS will be seeking a consistency review and possibly a county coastal permit pursuant to the California Coastal Act.

4.2.1.2 Assessment Methods

The principle concerns in analyzing effects related to geology, geologic hazards, and soils center on the potential for a proposed action to create or increase risk to life and property from geohazards, such as slope failure and liquefaction hazard. This analysis considers existing geologic conditions, including seismic hazards, in assessing the effects of a proposed action. Descriptors for evaluating impacts effect, duration, and intensity are shown in Table 4.2.

In addition, proposed actions are assessed for their potential to harm geologic and soil resources of the Seashore. Many soils resources, and some geologic resources, at PRNS have been disturbed by previous activities, including farming, ranching, gravel extraction, and road construction. The intention of this project is 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. In addition, the project seeks to minimize alterations to PRNS geology as a result of the Project.

Table 4.2 Descriptors for Geology, Geohazards, and Soils Effects

Type of Effect	Beneficial: the proposed action would decrease or not effect risks to life and property from geohazards, and/or would improve or maintain the condition of geologic and soils resources
	Adverse: the proposed action would increase risks to life and property from geohazards, and/or degrade geologic and soils resources
Duration of Effect	Short-term: effects would occur in the first 2 years following construction
	Long-term: effects would persist beyond the 2-year post-construction period
Intensity of Effect	Negligible: Risk to safety and property would not be measurably increased; conditions of geologic and soils resources would not be measurably degraded
	Minor: Risks to safety and property would increase slightly, but the number of persons effected would be small, the financial risk would be small and easily

	recoupable; conditions of geologic and soils resources would degrade only slightly, but measurably
	Moderate: Risks to safety and property would increase markedly; conditions of geologic and soils resources would degrade not only measurably but also noticeably
	Major: Risks to safety and property would be substantially increased, a large number of persons would be effected and/or there would be substantial financial risk; conditions of geologic and soils resources would be substantially degraded

4.2.2 Air Quality

4.2.2.1 Policies and Regulations

Federal and State Guidance. Air quality is regulated under the federal and California Clean Air Acts and amendments. Pursuant to these regulations, the state and federal governments have established ambient air quality standards for 6 "criteria" pollutants: carbon monoxide, ozone, particulate matter of less than 10 microns in diameter, oxides of nitrogen, sulfur dioxide, and lead. Within the San Francisco Bay Area Air Basin, the BAAQMD ensures that these standards are not exceeded. The BAAQMD also issues permits for various activities that may affect air quality.

Air Quality Management at Point Reyes National Seashore. Scenic resources are extremely sensitive to air pollution. For example, even a very small amount of fine particulate matter can affect a viewer's ability to perceive colors, contrast, texture, and form of features, landmarks, and panoramas. Consequently, visual air quality is very important to park visitors.

PRNS is classified as a mandatory Class I area under the Federal Clean Air Act and its amendments. This classification requires the NPS to prevent significant deterioration of air quality as a result of park activities. The NPS is responsible for protecting the Seashore from impacts to ambient air quality and air quality related values, such as visibility and the protection of natural and cultural resources from the effects of contaminants.

4.2.2.2 Assessment Methods

Analysis of the effects of air quality in this document focuses on construction activities, because "operation" of the culvert crossings after project completion (including monitoring, maintenance, in inspection visits by NPS staff) is not expected to result in substantial pollution emissions, or in an substantial change in emissions in comparison with current operations and maintenance practices. Descriptors for evaluating impacts effect, duration, and intensity are shown in Table 4.3.

This analysis is in accordance with the guidelines published by the BAAQMD (1999). Although construction vehicle exhaust represents a source of pollutants, its contribution to construction-related emissions is comparatively minor; the primary concern with regard to construction-related emissions is generation of fugitive dust, with a specific concern for inhalable particulate matter (PM10). The BAAQMD does not require quantification of construction emissions if project proponents agree to implement specific, stipulated dust control measures, as are described in Appendix B of this document. Accordingly, this analysis provides a qualitative assessment of the potential of each proposed project to generate PM10.

Table 4.3 Descriptors for Air Quality

Type of Effect	Beneficial: the proposed action would improve or maintain air quality while lowering the potential for substantial pollutant releases
	Adverse: the proposed action would result in the degradation of ambient air quality or increase the potential for pollutant releases

Duration of Effect	Short-term: discharge of air-born pollutants would be confined to the construction period, and would persist for no more than 3 days past project completion at each project area
	Long-term: discharge of air-born pollutants would continue past the construction period, and/or air quality degradation as a result of the project would persist for more than 3 days past project completion at each project area
Intensity of Effect	Negligible: Dust and emissions would be barely perceptible or detectable, and would effect a lightly-visited area with no recreational trails or habitable structures
	Minor: Dust and emissions would be detectable but would be highly localized within a lightly visited area; emissions would have no lasting effects
	Moderate: Dust and emissions would be readily perceptible but would be localized in a lightly visited area; air quality degradation would limit the use of the area for no longer than one day, and would result in no lasting effects on human health or park resources
	Major: Dust and emissions would be readily noticeable, would occur in a heavily used area resulting in a potential hazard to human health; air quality changes as a result of project activities could substantially degrade natural and/or cultural resources; air quality changes would have lasting effects

4.2.3 Soundscapes

4.2.3.1 Policies and Regulations

Federal Guidance. The National Park Service Director's Order #47 addresses protection of natural soundscapes in parks, and prevention of excessive or inappropriate levels of noise on park lands. It requires managers to:

- Measure acoustic baseline conditions;
- Determine which existing or human-made sounds are consistent with park purposes;
- Set acoustic management goals and objectives based on those purposes; and
- Determine which noise sources are impacting the park and need to be addressed by management.

In addition to specific NPS guidance regarding natural quiet, Federal and State Endangered Species Acts may constrain noisy activities to non-breeding seasons to limit impacts to protected animals.

Local Guidance. Ambient noise levels in areas adjacent to the Seashore are regulated by the Noise Element of the Marin Countywide Plan (County of Marin 1994). Compliance with the County's Noise Element entails the development of appropriate mitigation measures to minimize noise effects on sensitive resources. Such mitigation measures may include: limits on the times which construction can occur, access routes, locations of staging areas, and construction equipment to be employed.

4.2.3.2 Assessment Methods

"Operation" of the sites after project completion, including inspection and maintenance visits, is not expected to generate a substantial amount of noise, or to materially change the natural quiet from current conditions. Consequently, analysis of noise-related to construction activities, including increased traffic of heavy equipment, and employment of heavy equipment on site, is evaluated qualitatively, based on experience with similar projects at Point Reyes National Seashore. Descriptors for evaluating impacts effect, duration, and intensity are shown in Table 4.4.

Table 4.4 Descriptors for Soundscape and natural quiet

Type of Effect	Beneficial: the proposed action would preserve or improve natural quiet at and/or adjacent to the project site
	Adverse: the proposed action would increase noise levels at and/or adjacent to the project Site
Duration of Effect	Short-term: changes to natural quiet would be confined to the construction period
	Long-term: changes to natural quiet would continue past project completion; "operation" of the sites would create changes to natural quiet relative to existing conditions
Intensity of Effect	Negligible: Changes to natural quiet would be barely perceptible or detectable, and would effect only the project Site
	Minor: Changes to natural quiet would be detectable but small, and would be limited to the project site and to access roads between main roads and the project site
	Moderate: Changes to natural quiet would be readily perceptible; these changes may effect park animals but only slightly; impacts would be perceptible beyond the immediate project site and associated access roads
	Major (adverse): Changes to natural quiet would be substantial, and potentially damaging to humans working in or visiting the project site; impacts may measurably impact park animals through loss of foraging ability or reproductive success; impacts would be noticeable throughout the Drakes Estero Watershed

4.2.4 Hydrologic and Geomorphic Processes, including Water Quality

4.2.4.1 Policies and Regulations

PRNS operates under many Federal, State, and local mandates intended to protect and preserve water quality and streamflow characteristics. These mandates are described in this section.

Federal Guidance. The Clean Water Act is the primary federal law that protects the quality of the nation's surface waters. It operates on the principle that discharges into the nation's waters are unlawful unless specifically authorized by permit.

CWA § 404 regulates the discharge and fill of discharge and dredged materials into "waters of the United States" which include oceans, bays, rivers, streams, lakes, ponds, and some wetlands. Section 404 permits are granted only for the least environmentally damaging practicable alternative.

CWA § 402 regulates construction-related stormwater discharges to surface waters through the National Pollutant Discharge Elimination System NPDES program administered by the Environmental Protection Agency (EPA). The EPA delegates administration of the NPDES program to Regional Water Quality Control Boards (RWQCBs); PRNS is in the jurisdiction of the San Francisco Bay RWQCB. Most construction projects which will disturb more than one acre of land are required to apply to their RWQCB for a NPDES General Permit for Construction Activities. Applicants must file a public notice of intent to discharge stormwater, and prepare and implement a stormwater pollution prevention plan. This plan describes proposed activities and Best Management Practices to minimize pollutant discharge and soil erosion. Permitees are required to conduct annual monitoring and reporting to assure that Best Management Practices are correctly implemented and effective in controlling the discharge of stormwater-related pollutants.

CWA § 401 requires agencies, which obtain a federal permit to conduct discharge-producing activities, to also obtain a state certification for the activity. Section 401 certification for projects at PRNS fall under the jurisdiction of the San Francisco Bay Area RWQCB.

Under CWA § 303(d), the state of California has established water quality standards to protect the beneficial uses of state waters. This statute requires states to identify water bodies whose water quality is

"impaired" or "limited" by the presence of pollutants or contaminants. The statute also requires the state to establish limits for discharge into water bodies which correspond with the maximum quantity of a particular contaminant that the water body can assimilate without experiencing water quality declines.

State Guidance. The California Porter-Cologne Water Quality Control Act created the State Water Resources Control Board and 9 RWQCBs to protect the state's surface water through implementation of the Federal CWA. In addition to assuring implementation of the CWA, the Porter-Cologne Act requires the development and periodic review of water quality control plans (Basin Plans) that describe the beneficial uses of California's major rivers and groundwater basins and establish water quality objectives for those waters.

Point Reyes National Seashore Activities. The NPS is currently sponsoring several research and monitoring efforts aimed at improving water quality at PRNS. Work now in progress includes:

- Expansion of the PRNS water quality monitoring program to include sites throughout the Seashore
- Assessment of the water quality impacts of rangeland use
- Identification of artificial water impoundments in designated wilderness areas that offer habitat for the California red-legged frog (*Rana aurora draytonii*) in order to develop a management plan that will ensure the maintenance of the most critical breeding habitat impoundments
- Development of a Geographic Information Systems (GIS) water resources atlas for PRNS
- Establishment of stream gauges in high-priority locations throughout the Seashore.

In addition, the NPS is currently developing a Water Resources Management Plan for PRNS. This plan is intended to be a comprehensive yet flexible management tool to document existing water resources and systems, identify inventory and monitoring needs, and establish guidance for water resource management for the Seashore over the next 10-15 years.

4.2.4.2 Assessment Methods

As described in Section 2.4 and Appendix B of this document, the NPS is committed to implementing a comprehensive set of Best Management Practices (BMPs) to limit or eliminate degradation to park resources as a result of construction activities. The BMPs outlined in Appendix B include provisions for trapping sediment and pollutants during construction, and for monitoring site conditions during and after construction. Channeling streams into temporary road-bypass structures will assure that streamflow continues around the road crossing site during construction. Bypass structures would be removed after project completion. Descriptors for evaluating impacts effect, duration, and intensity are shown in Table 4.5.

Analysis of the effects of the proposed actions on hydrology, hydraulics, and water quality draws from both qualitative and quantitative studies. The following reports contributed substantially to this analysis:

- Culvert Replacement Pre-design Investigations - final report (NHC 2002)

Additional non-quantitative investigations were performed in preparation for this assessment.

Table 4.5 Descriptors for Hydrologic and Geomorphic Processes, including Water Quality

Type of Effect	Beneficial: the proposed action would restore natural hydrologic and geomorphic process by removing impediments to flood flows, stabilizing riverbanks, etc.; the project would improve water quality and improve or maintain aquatic habitat; the proposed actions would improve or maintain groundwater hydrologic function and quality
	Adverse: the proposed action has the potential to alter natural surface water drainage, impede groundwater discharge, or alter groundwater flow by excess withdrawals. The proposed action could alter or prevent progress toward

	natural hydrologic and shoreline processes. The proposed action has the potential to degrade surface- or groundwater quality, impede progress toward improved water quality, or degrade aquatic habitat
Duration of Effect	Short-term: effects would be confined to the construction period, and to the period 2 years after construction
	Long-term: effects would persist for 2 years or more beyond the construction period
Intensity of Effect	Negligible: effects would be so slight as to be immeasurable, and would be limited to the immediate project site vicinity
	Minor: effects would be measurable, but would be limited in areal extent; there would be no potential for impairment (CWA, not NPS, definition of "impairment") of beneficial uses of associated water bodies
	Moderate: effects would be apparent at the local scale, and affect an area beyond the immediate project vicinity. Beneficial uses of associated water bodies could be (CWA) impaired; human health conditions and/or ecosystem integrity could be degraded; the result of the impacts would have the potential to become larger
	Major: effects would be substantial, highly noticeable, and regional; the beneficial uses of associated water bodies would be (CWA) impaired, and human health conditions and ecosystem integrity would be substantially degraded

4.2.5 Floodplains, Wetlands, and Riparian Zones

Floodplains, wetlands, and riparian zones are addressed specifically in this assessment because, as habitat for many of the plants and animals in a given landscape, they are protected by numerous laws and directives.

4.2.5.1 Policies and Regulations

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 pre-disturbance conditions" (NPS 2000).

The protection of floodplains, wetlands, and riparian corridors within NPS units is facilitated through the following:

- Rivers and Harbors Act § 10
- Clean Water Act § 404
- Executive Order 11988, Floodplain Management
- 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)

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 and riparian zones. Executive Order 11988 requires that federal agencies minimize the amount of infrastructure placed in floodplains. 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.

Executive Order 13112 directs federal agencies to minimize introduction and spread of exotic species to federal lands. In addition, the 2001 NPS Management Policies § 4.4.4.2, mandate NPS employees to distinguish which non-native species are most likely to cause damage to natural resources, and to give high priority to controlling their spread .

Actions proposed under this assessment have little potential for introducing invasive animal species. However, heavy equipment use proposed under the action alternatives has the potential to import plant materials from outside the park, and to transport plant materials between project sites. The park will employ Best Management Practices (outlined in Appendix B of this document) to minimize the chance of invasive species becoming established in the park, or moving between sites within the park, as a result of proposed actions.

4.2.5.2 Assessment Methods

For this assessment, wetlands and riparian zones that could be subject to impacts were identified using the USFWS - Cowardin Method surveyed in the field (Cowardin et al. 1979). 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 U.S. Army Corps of Engineers when defining wetlands. It is assumed that if these parameters were altered as a result of restoration activities, the wetland would be subject to impacts, which could be either beneficial or adverse.

Similarly, floodplains that could be subject to impacts were mapped and overlain with the boundaries of the project area. Impacts to floodplains resulting from this project could include direct alteration of vegetation communities; increased channel bed erosion, which would cause floodplains to be abandoned as channels downcut; and increased lateral erosion, which could cause unnatural erosion of floodplain terraces. It is assumed that abrupt changes in floodplain vegetation communities, or increases in channel erosion, as a result of this project would constitute an adverse effect on the natural environment.

Baseline conditions will be established at each site with regard to the presence or absence of non-native plant and animal species. The analysis of potential impacts associated with each alternative is based on the professional judgment of NPS employees, the park's Best Management Practices, site conditions, and experience with similar, completed projects. Descriptors for evaluating impacts effect, duration, and intensity are shown in Table 4.6.

Table 4.6 Descriptors for Floodplains, Wetlands, and Riparian Zones

Type of Effect	Beneficial: the proposed project would enhance or restore processes necessary for wetland vegetation, soils, or hydrology to develop, or increase the areal extent of wetlands; the project would facilitate processes associated with natural floodplain development; the proposed project would have no potential to introduce or spread non-native invasive species
	Adverse: the proposed action would shift plant species composition to a higher percentage of non-wetland indicator species; alter hydrologic features/factors that are required to maintain the wetland; alter soil properties that are required to maintain the wetland; or reduce the areal extent of wetlands; the proposed action would cause an abrupt shift in floodplain plant communities, and cause

	unnaturally accelerated erosion of channel bed and/or banks; the proposed action has the potential to introduce or spread non-native plant or animal species in the park
Duration of Effect	Short-term: effects wetlands and floodplains would persist for 2 years or less
	Long-term: effects on wetlands and floodplains would persist for 2 years or more beyond the construction period
Intensity of Effect	Negligible: the proposed action would not measurably alter wetlands and floodplains
	Minor: effects to wetlands and/or floodplains would be perceptible, but would be localized in extent
	Moderate: effects to wetlands and/or floodplains would be apparent and readily noticeable, but would be localized in extent; these changes may be permanent, unless (if adverse) actively managed
	Major: effects to wetlands and/or floodplains would be substantial, and would effect a significant portion of the Drakes Estero Watershed; changes would be irreversible, even (if adverse) with active management

4.2.6 Wildlife

4.2.6.1 Policies and Regulations

Federal and State Guidance. National Park Service guiding documents require the protection of wildlife in the park. The primary directive to protect park animals is found in the NPS Organic Act, which calls on park managers ". . . to conserve the scenery and the natural and historic objects and the wild life therein . . ." "Wild life" in this statement refers to naturally-occurring park biota, including, but not limited, to traditional "wildlife." In this context park animals, including invertebrates, fish, amphibians, reptiles, mammals, and birds within parks must receive a high standard of protection.

4.2.6.2 Assessment Methods

Descriptors for evaluating impacts effect, duration, and intensity are shown in Table 4.7.

Table 4.7 Descriptors for Wildlife

Type of Effect	Beneficial: the proposed action would improve habitat for plant or animal, and protect and/or restore the natural abundance and distribution of plant or animal species
	Adverse: the proposed action would degrade habitat for a plant or animal, and cause a decrease in the natural abundance and distribution of a plant or animal species
Duration of Effect	Short-term: effects on the habitats of species would persist for 2 years or less; immediate changes in the abundance and/or distribution of special-status species may occur during the construction period, but a return to original conditions would be expected within two generations of that species
	Long-term: effects on the habitats of species would persist for 2 years or more beyond the construction period; changes in the abundance and/or distribution of special-status species would continue beyond two generations of that species
Intensity of Effect	Negligible: the proposed action would not measurably alter habitats for species, or create a measurable difference in the distribution and abundance of special-status species

	Minor: adverse effects to habitats of species would be perceptible, but would be localized in extent; changes in the distribution and abundance of special-status species would be minor and restricted to the project site
	Moderate: adverse effects to habitats of species would be apparent and readily noticeable, but would be localized in extent; changes in the distribution and abundance of species would be moderate in intensity and restricted to the project site and sites immediately adjacent; changes in distribution and abundance of species may be permanent, unless (if adverse) actively managed
	Major: adverse effects to habitats of species would be substantial, and would effect a significant portion of the Drakes Estero Watershed; changes in the distribution and abundance of species would be substantial, and would effect a large geographic area; changes in distribution and abundance of these species is irreversible, even (if adverse) with active management

4.2.7 Special Status Species

4.2.7.1 Policies and Regulations

Federal and State Guidance. NPS Management Policies (NPS, 2000) provide a higher level of protection for animal species listed as threatened or endangered by the Federal Endangered Species Act: "The National Park Service will identify and promote the conservation of federally listed threatened, endangered, or candidate species within park boundaries and their critical habitats.... The National Park Service also will identify 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.... 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 plans and NEPA documents (NPS-77 Natural Resource Management Guidelines).

The Federal and California State Endangered Species Acts (ESAs) define the plant and animal species that are to be especially protected due to their imperiled status. These mandates list the protected animals as threatened or endangered, and protect habitat necessary to their continuance. The acts are administered by:

- The U.S. Fish and Wildlife Service (USFWS) (Federal ESA, terrestrial and freshwater species),
- The National Oceanic and Atmospheric Administration's Marine Fisheries Service (Federal ESA, marine and anadromous fishes), and
- The California Department of Fish and Game (California ESA).

The Federal and California State Endangered Species Acts categories for special-status species defined below in Table 4.8.

Table 4.8 Federal and California State ESAs Definitions

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.

Furthermore, the Federal Endangered Species Act may specify *critical habitat* – habitat necessary for the survival of a listed species, subspecies, or population – and may limit human activities in these designated areas.

The Federal Endangered Species Act requires federal agencies to consult with the USFWS before taking actions that (1) could jeopardize the continued existence of 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 document.

Under NEPA, PRNS is required to consider whether 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.

The Federal Migratory Bird Treaty Act enacts the provisions of treaties between North American and European countries. Over 800 bird species are protected under the legislation. It mandates federal agencies to consider impacts to protected breeding birds during implementation of projects on Federal lands, including disruption to nesting and egg-laying activities.

Local and Non-Governmental Guidance. The California Native Plant Society (CNPS) lists plant species which merit special protection but which may or may not appear on Federal and California Endangered Species lists. PRNS considers impacts to CNPS-listed species when undertaking a construction or restoration project. The Seashore also recognizes a number of species as locally rare or of special concern, even though they are not officially listed. Species in these categories, as well as those listed by the Federal of California ESAs, are collectively referred to in this document as "special-status species."

The Federal and California State Endangered Species Acts categories for special-status species are defined in Table 4.9.

Table 4.9 California Native Plant Society Definitions

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

4.2.7.2 Assessment Methods

Point Reyes National Seashore supports 27 federally protected species. Within the project areas of the Coastal Watershed Restoration – Culvert Replacement Project special status species are known to occur, including:

- Coastal California steelhead (*Oncorhynchus mykiss,* federally listed Threatened Species; FT)
- Essential Fish Habitat for coho salmon (*Oncorhynchus kisutch*; federally listed Threatened Species; FT).
- California red-legged frog (*Rana aurora draytonii,* federally listed Threatened Species; FT)
- Breeding habitat for listed neotropical migrant bird species and habitat protected through the Neotropical Migratory Bird Act.

Baseline conditions of these species and their habitats were identified through literature reviews and field surveys. Fieldwork included:

- Reconnaissance-level surveys in and adjacent to the project sites to assess the suitability of habitat for use by common and special-status wildlife species,
- Wetland delineation and special-status plant species, and
- California red-legged frog surveys (Fellers and Guscio 2002)

Potential effects of the proposed action on special-status species are assessed qualitatively, based on the professional judgment of PRNS employees in light of existing environmental conditions and familiarity with similar, completed projects. Temporary, construction-related effects are distinguished from long-term effects related to post-restoration adjustments in habitat patterns. Descriptors for evaluating impacts effect, duration, and intensity are shown in Table 4.10.

Table 4.10. Descriptors for Special Status Species

Type of Effect	Beneficial: the proposed action would improve habitat for a special-status plant or animal, and protect and/or restore the natural abundance and distribution of a special-status plant or animal species
	Adverse: the proposed action would degrade habitat for a special-status plant or animal, and cause a decrease in the natural abundance and distribution of a special-status plant or animal species
Duration of Effect	Short-term: effects on the habitats of special-status species would persist for 2 years or less; immediate changes in the abundance and/or distribution of special-status species may occur during the construction period, but a return to original conditions would be expected within two generations of that species
	Long-term: effects on the habitats of special-status species would persist for 2 years or more beyond the construction period; changes in the abundance and/or distribution of special-status species would continue beyond two generations of that species
Intensity of Effect	Negligible: the proposed action would not measurably alter habitats for special-status species, or create a measurable difference in the distribution and abundance of special-status species
	Minor: adverse effects to habitats of special-status species would be perceptible, but would be localized in extent; changes in the distribution and abundance of special-status species would be minor and restricted to the project site
	Moderate: adverse effects to habitats of special-status species would be apparent and readily noticeable, but would be localized in extent; changes in the distribution and abundance of special-status species would be moderate in intensity and restricted to the project site and sites immediately adjacent; changes in distribution and abundance of species may be permanent, unless (if adverse) actively managed
	Major: adverse effects to habitats of special-status species would be substantial, and would effect a significant portion of the Drakes Estero Watershed; changes in the distribution and abundance of special-status species would be substantial, and would effect a large geographic area; changes in distribution and abundance of these species is irreversible, even (if adverse) with active management.

4.2.8 Cultural Resources

4.2.8.1 Policies and Regulations

Federal Agencies are mandated to protect cultural resources by the National Historic Preservation Act, Section 106. Although NHPA § 106 requires a slightly different impact analysis than does the National Environmental Policy Act (NEPA), compliance obligations under these two federal mandates are typically integrated into a single NEPA assessment document. These differences are described below under "Assessment Methods."

The NHPA requires that before initiating an action, the NPS must evaluate the project's potential adverse effects on resources eligible for listing on the National Register of Historic Places. In addition, the NPS must solicit comments from the Advisory Council on Historic Preservation, the California State Historic Preservation Office (SHPO), and other interested parties. The NPS and the SHPO must come to an agreement regarding mitigation for adverse effects on historic resources. This agreement must be outlined in a Memorandum of Agreement between the two agencies.

In addition, NPS Director's Order #28 provides guidance for managing archeological resources, cultural landscapes, historic and pre-historic structures, museum objects, and ethnographic resources. When evaluating potential impacts to these resources, NPS managers must consider the resources' significance, context, and integrity.

NPS policy and legislation directs the agency to consult with local tribal government prior to initiating an action that may effect the human environment.

4.2.8.2 Assessment Methods

Under Section 106 of the NHPA the NPS must evaluate a project's potential direct impacts, operational impacts, and indirect impacts on cultural resources.

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.

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, NHPA § 106 process considers only the adverse effects upon cultural resources, not potentially beneficial ones. A qualitative 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.

For the purpose of this evaluation, Section 106 effect categories are considered, and a qualitative scale is used to show impact intensity. Descriptors for evaluating impacts effect, duration, and intensity are shown in Table 4.11.

Table 4.11 Descriptors for Cultural Resources

Type of Effect	Beneficial: the proposed action would protect the significant characteristics of cultural resources from adverse effects, or would restore them to some desired condition

	Adverse: the proposed action would result in adverse changes in the significant characteristics of cultural resources; adverse effects may include perceptible and measurable effects, as well as imperceptible psychological or emotional effects
Intensity of Effect	Negligible: adverse effects to the integral characteristics of cultural resources would be so slight as to be immeasurable and imperceptible
	Minor: adverse effects create perceptible and measurable changes to the integral characteristics of cultural resources, but would affect only a small percentage of the resources' integral characteristics; adverse effects would not reduce the interpretive potential of the site
	Moderate: adverse effects create perceptible and measurable changes to the integral characteristics of cultural resources, but would affect only a moderate percentage of the resources' integral characteristics; adverse effects would not reduce the interpretive potential of the site
	Major: adverse effects create perceptible and measurable changes to a substantial portion of the integral characteristics of cultural resources; adverse effects could or would reduce the interpretive potential of the site

4.2.9 Recreational Resources, Visitor Experience, and Aesthetic Resources

4.2.9.1 Policies and Regulations

A primary purpose of the protection of NPS lands is the preservation of natural and cultural resources for the enjoyment of park visitors. The NPS Director's Order #12, which provides guidelines for preparation of NEPA documents for NPS units, specifies that before beginning a project, the NPS must evaluate potential impacts to recreational resources, visitor experiences of natural and cultural resources, and the aesthetic integrity of the park landscape.

The Point Reyes National Seashore enabling legislation called for the preservation of a portion of the diminishing undeveloped seashore of the United States for the ". . . purposes of public recreation, benefit, and inspiration . . . " (16 USC § 459c).

4.2.9.2 Assessment Methods

The project's long-term goals are to maintain current access at 6 road/creek crossings while protecting natural and cultural resources. During project implementation, actions will be taken to minimize disruption to visitor access and enjoyment of the Drakes Estero Watershed. In addition, measures will be employed to protect visitor safety. These mitigation measures are found in Appendix B: Best Management Practices. During implementation, PRNS may close some trails and roads to public access, in order to protect visitor safety. The shore-term effects of these closures, and the long-term impacts on accessibility and aesthetics are analyzed qualitatively. Descriptors for evaluating impacts effect, duration, and intensity are shown in Table 4.12.

Table 4.12 Descriptors for Recreational Resources, Visitor Experience, and Aesthetic Resources

Type of Effect	Beneficial: the proposed action would enhance visitation and improve the visitor experience of the natural and cultural resources of the park
	Adverse: the proposed action would reduce visitation to the project site and detract from the visitor experience of the natural and cultural resources of the park
Duration of	Short-term: changes to visitation and the visitor experience would be confined to

Effect	the construction period
	Long-term: changes to visitation and the visitor experience would continue past project completion; "operation" of the sites would create changes to visitation and the visitor experience relative to existing conditions
Intensity of Effect	Negligible: Changes to visitation and the visitor experience would be barely perceptible or detectable, and would effect only the project site; aesthetic resources would not be noticeably effected
	Minor: Changes to visitation and the visitor experience would be detectable but small, and would be limited to the project site and to the access roads between main roads and the project site; these sites may be closed to visitor use altogether; aesthetic resources would not be substantially effected
	Moderate: Changes to visitation and the visitor experience would be readily perceptible; impacts would be perceptible beyond the immediate project site and associated access roads; sites beyond the immediate project site would be rendered inaccessible to park visitors; aesthetic resources may be substantially effected, but only in localized portions of the project site
	Major (adverse): Changes to visitation and the visitor experience would be substantial; impacts would be noticeable throughout the Drakes Estero Watershed; sites beyond the immediate project site would be rendered inaccessible to park visitors; aesthetic resources may be substantially effected throughout the project site and beyond

4.2.10 Public Safety and Transportation

4.2.10.1 Policies and Regulations

The health and safety the public, employees and contractors is the highest priority in National Park Service actions.

4.2.10.2 Assessment Methods

The project's long-term goals are to maintain current access at 6 road/creek crossings while protecting natural and cultural resources. The project will result in temporary closure during construction and some additional traffic impacts associated with mobilization, demobilization, and materials transport. In addition, measures will be employed to protect visitor safety. These mitigation measures are found in Appendix B: Best Management Practices. During implementation PRNS may close some trails and roads to public access, in order to protect visitor safety. The short-term effects of these closures, and the long-term impacts on accessibility and aesthetics are analyzed qualitatively. Descriptors for evaluating impacts effect, duration, and intensity are shown in Table 4.13.

Table 4.13 Descriptors for Public Health and Safety

Type of Effect	Beneficial: the proposed action would protect or improve public health and safety of the natural and cultural resources of the park
	Adverse: the proposed action would reduce the public health and safety at the project site.
Duration of Effect	Short-term: changes to public health and safety would be confined to the construction period (temporary)
	Long-term: changes to public health and safety would continue past project completion.
Intensity of	Negligible: Changes to public health and safety would be barely perceptible or

Effect	detectable, and would effect only the project site; aesthetic resources would not be noticeably effected
	Minor: Changes to public health and safety would be detectable but small, and would be limited to the project site and to the access roads between main roads and the project site
	Moderate: Changes to public health and safety would be readily perceptible; impacts would be perceptible beyond the immediate project site and associated access roads.
	Major (adverse): Changes to public health and safety would be substantial; impacts would be noticeable throughout the Drakes Estero Watershed.

5.0 Impacts Analysis

This chapter analyzes the potential effects of Alternatives A, B, and C on the environmental resources described in Chapter 3. Where appropriate, it also identifies mitigation strategies that could be implemented to avoid or reduce adverse effects. Analysis is generally presented separately for each alternative with descriptions encompassing the 6 project sites. Analysis of effects is described as a range for the overall project area, with tables in the conclusion sections describing potential impacts at each project site.

5.1 Geology, Geohazards, and Soils

The 3 alternatives proposed by this document would result in varying impacts to geologic and soils resources, and varying risks from earthquake, landslide, and debris flow hazards.

5.1.1 Alternative A

Under Alternative A, no planned culvert upgrade would take place. No impact to geologic and soils resources would occur as a result of construction activities. However, under this alternative many of the 6 undersized and failing crossing structures considered in this document would continue to impede natural hydrologic and floodplain process, deposition and erosion patterns, and have the potential to fail catastrophically, causing severe damage to soils resources. In addition, under Alternative A existing hazards from seismicity would remain. Existing management activities, including emergency repair and debris clearing activities, would continue.

5.1.1.1 Analysis

Because no new earthwork activities would take place, Alternative A would not result in immediate impacts to geologic or soils resources. Impacts to geologic and soils resources from ongoing maintenance and periodic facility cleaning activities would result in negligible adverse effects in the short term. However, these activities could not effectively mitigate the continuing risks associated with the failing and undersized culverts at the 6 crossing sites. In the long term, the potential for catastrophic failure at the sites could result in minor to moderate adverse effects. These risks include:

- **Risk of culvert failure due to geohazards.** Two of the 6 crossing structures – at Mount Vision and Estero Road – are in failing condition due to age and severe downstream erosion. Two of the remaining culverts – at Home Ranch and North Home Ranch – are in fair to poor condition and are at moderate risk for failure. While seismic events are a possibility, failure would likely occur as a result of a debris flow or landslide event similar to the events of January 1982. Failure could include mobilization of additional debris within such a debris flow, or damming of material in an unnatural location, resulting in concentrated deposition at the point of the structure. Catastrophic failure of one or more of these structures as a result of seismic activity could pose hazards to human safety; these risks are addressed in section 5.10, Public Safety and Transportation. Such a catastrophic failure would also degrade aquatic habitat downstream of the failure due to the potential mobilization of large quantities of sediment.

- **Risk of culvert failure due to flood flows.** The 6 culverts are at some risk for failing under high flood flows. Two of the structures – at Mount Vision and Estero Road – are at high risk for failure as they are degraded and occupy high gradient positions within their subwatersheds. Overtopping or failure leading to mobilization of large amounts of the streambed and banks could occur under high flow scenarios. Mobilized bed and bank material, moving downstream at high velocity could even initiate debris flows with the potential to cause severe downstream channel erosion. Upstream headcutting would likely occur as the streambed adjusts to conditions without the culvert bed control. Furthermore, even if the culverts themselves could withstand high flows,

mass wasting events, unrelated to the culvert structures, either upstream or downstream of these crossings, could be greatly exacerbated if they incorporated the crossing sites and caused culvert failures. A failure of the culvert at the Upper Laguna site may cause moderate upstream channel widening. Structures at the remaining crossings could fail under flood conditions, but at their locations in the watershed, impacts would be more localized.

5.1.1.2 Cumulative Effects

The Fire Management Plan and Environmental impact statement proposes the use of prescribed fire in the Estero Fire Management Unit (FMU) incorporating the Estero, North Home Ranch, and Home Ranch crossings. Planning level mitigation in the fire plan will insure that, while the FMUs may cover more than 10% of any one watershed, activities in any given year will be limited to less than that 10% threshold. In this manner, watershed scale effects associated with burning would be limited.

The PRNS General Management Plan, in concept development phase at present, could propose actions that would have cumulative effects with Alternative A of this document. However, no such specific actions have been identified as yet in that document. Cumulative effects between actions proposed in the GMP and in this project would be disclosed in the Environmental Impact Statement prepared in conjunction with the General Management Plan.

Alternative A would result in no effect in the short term, but would lead to the potential for minor long-term adverse cumulative effects.

5.1.1.3 Conclusion for No Action Alternative Effects on Geology Geohazards and Soils

Under Alternative A, there would be no short-term risks to geologic or soils resources, or geohazards, as there would be no scheduled or planned actions at these sites. Routine maintenance of the existing facilities would result in negligible adverse short-term impacts. The condition of these facilities is such that they are subject to failure in the future, resulting in the potential for minor to moderate long-term adverse impacts under Alternative A. These impacts center on the risk of exacerbated stream channel erosion and the potential for catastrophic culvert failures.

Table 5.1. Alternative A: Overall Effects on Geology, Geohazards, and Soils

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Mount Vision Road	Geology, Soils	Negligible adverse	Moderate adverse
Estero Road	Geohazards	Negligible adverse	Moderate adverse
	Cumulative	No effect	Minor adverse
Home Ranch	Geology, Soils	Negligible adverse	Moderate adverse
North Home Ranch	Geohazards	Negligible adverse	Minor adverse
	Cumulative	No effect	Minor adverse
Upper Laguna	Geology, Soils	Negligible adverse	Moderate adverse
Lower Laguna	Geohazards	Negligible adverse	Minor adverse
	Cumulative	No effect	Minor adverse

Implementation of the Alternative A would not result in impairment of park geology or soil resources and would not exacerbate geohazards at the site.

5.1.2 Alternative B

Treatments proposed under Alternative B would require the employment of heavy equipment including excavators (all sites), cranes (all but North Home Ranch), loader, and dump truck (all sites). At Upper and Lower Laguna sites, Alternative B includes construction of bridge crossings at each site. Staging for this

equipment will occur on previously disturbed surfaces where possible, such as roads and parking lots. At some sites additional space may be needed. This may disturb up to 0.5 acre of land at each site. Best Management Practices, outlined in Appendix B of this document, will be employed to minimize soil disturbance during construction activities; these include wetting of soils to prevent destabilization of fine particles, and revegetation immediately after disturbance.

5.1.2.1 Analysis

Geologic Resources
Because of the presence of deep alluvial soils at the project sites, pile driving may be required to stabilize one or more of the proposed structures. The need for stabilization with pilings is currently being assessed by a geotechnical investigation. However, even where pilings will be required, no bedrock will be disturbed; piles will be driven only to the point of refusal (at or above the bedrock horizon). None of the construction activities proposed under Alternative B have the potential to damage or destroy geologic resources.

Soil Resources
Activities proposed for each site would have the potential to impact hydric soils and channel bed materials. The soils at each of the sites are mapped as either Rodeo clay loam or Humaquepts, seeped, both hydric soils (see Section 3.2.1.). Investigations conducted at the project sites verified the presence of hydric soils throughout the areas potentially to be disturbed by construction activities under Alternative B. In addition, the proposed activities would disturb stream bank and bed material – primarily cobble and gravel substrate with some sand intermixed – at all locations (see Table 5.1 above). Disturbances to wetland soils and to channel bed materials would include:

- soil compaction, mobilization of fine particles, removal or degradation of vegetative cover (all sites),
- excavation into native soils in stream beds and banks to install facilities or lay back bank (all sites),
- armoring with riprap (Upper and Lower Laguna),

Although activities proposed by Alternative B would actively disturb soils at the project sites, replacement of the existing failing and undersized culverts would alleviate existing risks of catastrophic culvert failure at these sites. Unlike the impacts of potential catastrophic failure described in Alternative A, impacts associated with Alternative B would be limited to the project area. In contrast to the Alternative A, incremental impacts to soil resources associated with Alternative B are negligible adverse in the short term, and beneficial in the long term.

Geologic Hazards
The replacement of the existing failing and undersized culverts with upgraded facilities, engineered to resist damage due to seismic activity, will greatly reduce the risks of catastrophic failure of these structures. This would alleviate potential damage to soils resources and aquatic habitats, and would minimize risks to human safety. The proposed actions under Alternative B would reduce potential failure as a result of geologic hazard and are considered beneficial in the long term.

5.1.2.2 Cumulative Effects

As with the cumulative effects between the Fire Management Plan (FMP) and Alternative A, described above, planning level mitigation in the fire plan will insure that, while the FMUs may cover more than 10% of any one watershed, activities in any given year will be limited to less than that 10% threshold and would avoid interaction with recently disturbed project areas.

The project would result in localized impacts to soils and geology, but reduced risk of failure associated with geologic hazards. The staging of projects and mitigation identified in Appendix B for erosion control

and water quality protection would result in negligible adverse cumulative effects to geology, soils and geohazards in the short term, but in the long term, the effects are considered beneficial.

Planning level controls and proposed environmental commitments will result in negligible adverse cumulative short-term and beneficial long-term effects to geologic and soil resources under Alternative B.

5.1.2.3 Conclusion for Alternative B Effects on Geology, Geohazards, and Soils

The potential impacts associated with implementation of Alternative B on geologic and soils resources, and on risks from geohazards are adverse, and negligible to minor in the short term, and beneficial in the long term. Short-term impacts include minor excavation of stream channel banks and beds, soil compaction and erosion due to heavy equipment traffic, and installation of short segments of riprap revetment on stream banks. Long-term effects would be decreases in the risk of culvert failures and decreases in unnaturally accelerated channel erosion.

Table 5.2 Alternative B: Overall Effects on Geology, Geohazards, and Soils

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Mount Vision Road	Geology, Soils	Minor adverse	Beneficial
Estero Road	Soils	Minor adverse	Beneficial
	Geohazards	Beneficial	Beneficial
	Cumulative	Negligible adverse	Beneficial
Home Ranch	Geology, Soils	Negligible adverse	Beneficial
North Home Ranch	Soils	Negligible adverse	Beneficial
	Geohazards	No effect	Beneficial
	Cumulative	Negligible adverse	Beneficial
Upper Laguna	Geology, Soils	Minor adverse	Beneficial
Lower Laguna	Soils	Minor adverse	Beneficial
	Geohazards	Minor adverse	Beneficial
	Cumulative	Negligible adverse	Beneficial

Implementation of the Alternative B would not result in impairment of park geology or soil resources and would not exacerbate geohazards at the site.

5.1.3 Alternative C

Alternative C proposes to replace culvert facilities at the 6 project sites improve aquatic habitats, to reduce risks associated with failing and undersized culverts, and to maximize long-term management flexibility. Alternative C is identical to Alternative B for the Mount Vision, Estero, Home Ranch, and North Home Ranch crossings; impacts associated with proposed construction activities at these sites are evaluated above in section 5.1.2. Alternative C differs from Alternative B at Upper and Lower Laguna crossings. At Upper Laguna Crossing, Alternative C proposes repair and stabilization of the sack concrete culvert headwall, and installation of 3 boulder structures in the creek bed to retard streambed erosion. At Lower Laguna crossing, Alternative C proposes installation of either a corrugated metal pipe arch, or a 12-foot by 8-foot concrete box culvert.

These alternatives would require the employment of heavy equipment including excavators, cranes, and pick-up trucks. Staging for this equipment will occur on previously disturbed surfaces where possible, such as roads and parking lots. At some sites, additional space may be needed. This may disturb up to 0.5 acres of land at each site. Best Management Practices, outlined in Appendix B of this document, will be employed to minimize soil disturbance during construction activities; these include wetting of soils to prevent destabilization of fine particles, and revegetation immediately after disturbance.

At the Lower Laguna crossing the structure that would be constructed under Alternative C would be either a corrugated metal arch or a concrete box culvert. The structure constructed under this alternative would be

determined through geotechnical investigation of the site, currently in progress. Either of these options would produce similar impacts, which are evaluated in this section.

5.1.3.1 Analysis

Geologic Resources
At the 6 project sites, proposed activities under Alternative C would have the same impacts on geologic resources as proposed activities under Alternative B. These potential impacts are discussed under section 5.1.2.1 above. None of the construction activities proposed under this Alternative have the potential to damage or destroy geologic resources.

Soil Resources
Earthmoving activities and heavy equipment use under Alternative C have the potential to disturb hydric soils and channel bed materials, but would result in less disturbance to soil resources at Upper Laguna and Lower Laguna than under Alternative B. The soils at each site are mapped as either Rodeo clay loam or Humaquepts, seeped, both hydric soils (see Section 3.2.1.). As with Alternative B, proposed activities would disturb stream bank and bed material – primarily cobble and gravel substrate with some sand intermixed at each site (see Table 5.2 above). Disturbances to wetland soils and to channel bed materials would include:

- soil compaction, mobilization of fine particles, removal or degradation of vegetative cover (all sites),
- excavation into native soils in streambeds and banks to install facilities or lay back bank (all sites).

Unlike activities proposed under Alternative B, Alternative C proposes no riprap revetment at Upper or Lower Laguna crossings. There would still be installation of boulder cross-vanes at the Upper Laguna site.

Geohazards
At the 6 project sites, proposed activities under Alternative C would have the same impacts on seismic risks as those proposed under Alternative B. These impacts are discussed under Section 5.1.2 – Geohazard. The impacts to Geologic Hazards as a result of activities proposed under Alternative C would be long-term and beneficial.

5.1.3.2 Cumulative Effects

Alternative C has the potential to cause cumulative effects on geology, geohazards, and soils if implemented in the same watersheds as other associated projects listed in Table 4.1 of this document. As described in Alternative B, effects associated with the project activities would remain localized. Planning level controls and environmental commitments would result in negligible adverse cumulative short-term and beneficial long-term effects to geologic and soil resources under Alternative C.

5.1.3.3 Conclusion for Alternative C Effects on Geology Geohazards and Soils

The potential effects of implementation of Alternative C on geologic and soils resources, and on risks from geohazards are adverse, and negligible to minor in the short term, and beneficial in the long term. Short-term impacts include minor excavation of stream channel banks and beds, and soil compaction and erosion due to heavy equipment traffic. Long-term benefits would be reduced risk of culvert failures and decreases in unnaturally accelerated channel erosion.

Table 5.3 Alternative C: Overall Effects on Geology, Geohazards, and Soils

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Mount Vision Road Estero Road	Geology, Soils Geohazards Cumulative	Same as Alternative B	

Home Ranch	Geology, Soils		
North Home Ranch	Geohazards	Same as Alternative B	
	Cumulative		
Upper Laguna	Geology, Soils	Minor adverse	Beneficial
Lower Laguna	Geohazards	Minor adverse	Beneficial
	Cumulative	Negligible adverse	Beneficial

Implementation of the Alternative C would not result in impairment of park geology or soil resources and would not exacerbate geohazards at the site.

5.2 Air Quality

Each of the 3 alternatives has the potential to degrade air quality through the use of heavy equipment to repair or upgrade culvert facilities. Heavy equipment use would increase concentrations of inhalable particulate matter (PM10) from earth moving activities, and also increase concentrations of ozone precursors from equipment exhaust.

5.2.1 Alternative A: No Action

5.2.1.1 Analysis

Under the Alternative A, no planned culvert replacement would take place, and existing routine maintenance activities would continue. If one or more of the culverts became blocked, or failed, heavy equipment may be mobilized to repair the crossing. Of the 6 crossings considered in this document, the Mount Vision and Estero Crossings are most likely to fail, but all 6 structures are at risk of failure. Replacement activities on site, in the event of failure, would be expected to take at least 2 to 3 weeks following such a failure event. Even if no failure occurs, routine maintenance for the existing structures would be substantially higher than for upgraded structures proposed under Alternatives B and C, due to the poor condition and/or inadequate conveyance capacity of the existing culverts. This emergency maintenance and repair could require the use of heavy equipment on site for up to one week per event.

The use of heavy equipment during such emergencies may cause temporary degradation of air quality. These emergency actions would be likely to take place during wet winter months, when atmospheric and soil moisture conditions would severely limit dust production and localize the effects of equipment exhaust. However, equipment use would create local, temporary increases in ozone precursors. Ozone precursors, such as reactive organic compounds (ROC) and nitrogen oxides (NO_x) are of concern in the Bay Area Air Basin, because this region is not able to meet regulatory standards and is considered a nonattainment area. Effects on air quality from Alternative A would not effect short-term air quality conditions, but could result in localized minor adverse effects in the long term.

5.2.1.2 Cumulative Effects

Under the Alternative A no planned culvert replacement would take place; emergency repairs would be unscheduled and would be highly unlikely to coincide with concurrent projects in the project areas or in the Drakes Estero Watershed. As a result, there would be no short-term cumulative effects on air quality, but in the long term cumulative effects could be considered adverse and minor.

5.2.1.3 Conclusion for No Action Alternative Effects on Air Quality

Under Alternative A, there would be no heavy equipment mobilized, except on an emergency basis. These repairs may cause degradation of air quality due to equipment exhaust and dust production. Emergency repairs to culverts would likely take place during seasonal periods in which precipitation and high soil moisture would minimize air quality effects from heavy equipment. Effects on air quality from Alternative A would not effect short-term air quality conditions, but could result in localized minor adverse effects in the long term.

Implementation of the No Action Alternative would not result in impairment of park resources.

Table 5.4 Alternative A: Overall Effects on Air Quality

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All crossings: - Mount Vision - Estero - Home Ranch - North Home Ranch - Upper Laguna - Lower Laguna	Air Quality Cumulative	No effect No effect	Minor adverse Negligible adverse

5.2.2 Alternatives B and C: Build Alternatives

Under Alternatives B and C, heavy equipment would be mobilized to the project areas to conduct culvert replacement and stream channel stabilization activities. While potential treatment actions at Upper Laguna and Lower Laguna differ under Alternatives B and C, the heavy equipment required for completion of either of these alternatives would have the same potential to increase dust production and create exhaust, which may affect air quality. Best Management Practices (BMPs), outlined in Appendix B of this document, describe dust control techniques that would be employed to minimize production of inhalable particulate matter during construction activities at the project areas. Both Action Alternatives, B and C, have similar capacities to affect air quality; therefore the potential impacts are assessed together.

5.2.2.1 Analysis

Alternatives B and C call for culvert replacement activities, including earthwork, which have the potential to temporarily increase pollutant emissions at each of the 6 project areas. Implementation of Alternatives B or C would markedly reduce the potential for catastrophic failures of these 6 crossing structures, and would also reduce the need for emergency repairs and cleanings in the long term. Since, in order to protect water quality and aquatic species, construction activities associated with Alternatives B or C would take place during the dry season, a small increase in the production of fugitive dust (PM10, or inhalable particulate matter) is expected. However, implementation of the BMPs outlined in Appendix B will reduce dust production. Emissions from heavy equipment would locally and temporarily degrade air quality at the project sites. These effects would not contribute measurably to air quality effects within the watershed, or within the Bay Area Air Basin. BMPs outlined in Appendix B outline requirements for emissions-producing equipment to comply with air quality protection standards.

Work at each site will be limited to either 2 or 3 weeks (see Table 2.4). Air quality effects would vary only by the expected duration of heavy equipment use; the severity of the effects from site to site and between alternatives would be similar.

With Best Management Practices (as outlined in Appendix B) in place, the incremental effects on air quality as a result of Alternatives B or C would be minor, short-term, and adverse.

5.2.2.2 Cumulative Effects

Alternatives B and C would have potential to cause cumulative effects on air quality if they coincided with associated projects listed in Table 4.1 of this document. Projects that could overlap with this one are the Coastal Watershed Project – Geomorphic Restoration, Glenbrook Dam and Quarry Restoration, as well as prescribed burning under the Fire Management Plan. Both construction actions would require heavy equipment use and earthwork, and would have the potential to increase the production of fugitive dust and equipment exhaust. In addition to PM10, ozone precursors are the greatest concern, because the SFBAAB is in non-attainment status for these pollutants.

The construction projects would occur during the construction window of August 1- October 31, 2005. Potentially, heavy equipment could be used simultaneously at 2 nearby sites. In addition to heavy equipment use at the project areas, increased vehicle and equipment traffic on roads accessing the project areas could create cumulative air quality impacts. However, the construction window for the actions that could potentially overlap would be short, and the total amount of earthwork required by the projects is small. Thus, the cumulative volume of pollutants generated during overlapping construction activities would be small. These pollutants would disperse quickly with coastal winds.

Burn planning requires consultation with the BAAQMD. Wind conditions and basin air quality are the most likely factors constraining scheduling of a burn operation. Cumulative pollutants from construction activities are negligible compared to the particulates produced by fires. The likelihood that these construction activities, cumulatively, would contribute to air quality exceedances or prevent burn operations in the Air Quality Basin is extremely small. Moreover, NPS BMPs would require that all work complied with the BAAQMDs Feasible Control Measure for PM10 and that heavy equipment met emissions standards.

Because of the limited area effected, the NPS BMPs which minimize production of fugitive dust and equipment exhaust, and the relatively short construction period, the Action Alternatives' effects on air quality would be minor, short-term, and adverse.

5.2.2.3 Conclusion for Action Alternatives Effects on Air Quality

Under both Action Alternatives, production of dust and equipment would be similar. NPS would require work to comply with the BAAQMDs Feasible Control Measures for PM10 and ensure that equipment met vehicle emissions standards. These mitigation measures are described in Appendix B of this document.

With these measures in place, the Action Alternatives (B & C) would result in minor, short-term, adverse impacts to the project sites. There would be no widespread or long-term impacts to air quality as a result of implementation of the Action Alternatives. Impacts to Air Quality would be slightly greater under Alternatives B or C than the No Action Alternative, because under the2 action proposals culvert replacement activities would take place during summer months in order to protect aquatic resources. In contrast, Alternative A might require the emergency replacement or repair of culvert during winter months, when atmospheric conditions and high soil moisture content would reduce the effects of fugitive dust and vehicle emissions.

Implementation of the Action Alternatives would not result in impairment of park resources.

Table 5.5 Alternatives B and C: Overall Effects on Air Quality

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All crossings: - Mount Vision - Estero - Home Ranch - North Home Ranch - Upper Laguna - Lower Laguna	Air Quality Cumulative	Minor adverse Minor adverse	No effect No effect

5.3 Soundscapes

5.3.1 Alternative A: No Action Alternative

5.3.1.1 Analysis

Alternative A would not change existing conditions and routine maintenance activities. Of the 6 crossings considered in this document, the Mount Vision and Estero Crossings are most likely to fail, but the 6 structures are at risk of failure. Replacement activities on site, in the event of failure, would be expected to take 2 to 3 weeks per failure. Even if no failure occurs, routine maintenance for the existing structures would be substantially higher than for upgraded structures proposed under Alternatives B and C, due to the poor condition and/or inadequate conveyance capacity of the existing culverts. This emergency maintenance and repair could require the use of heavy equipment on site for up to one week per event.

If winter storms blocked one or more of the culverts, or caused structural damage, heavy equipment could be mobilized to repair the crossing. The use of heavy equipment during emergency repairs could cause a temporary increase in noise levels at the project area(s). Emergency actions would be likely to take place during wet winter months, when atmospheric conditions would limit noise conveyance, and when the project areas experience relatively light human and animal use. There would be no effect on soundscapes in the short term, but in the long term, localized effects on soundscapes would be minor and adverse.

5.3.1.2 Cumulative Effects

Under the Alternative A no planned culvert replacement would take place. Emergency repairs would be unscheduled and would be highly unlikely to coincide with concurrent projects in the project areas or in the Drakes Estero Watershed.

Alternative A would not contribute to cumulative soundscape effects in the short term, and in the long term, potential soundscape effects would be localized, resulting in cumulative negligible adverse effects.

5.3.1.3 Conclusion for No Action Alternative Effects on Soundscapes

Under Alternative A there would be no heavy equipment mobilized, except on an emergency basis, which could cause increases in noise levels. Emergency repairs to culverts would likely take place during or immediately following winter storms during periods in which atmospheric conditions would minimize noise effects from heavy equipment, and when there is relatively little use of the project areas by humans. There would be no effect on soundscape in the short term, but in the long term, localized effects on soundscapes would be minor and adverse.

Table 5.6 Alternative A: Overall Effects on Soundscapes

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All crossings: - Mount Vision - Estero - Home Ranch - North Home Ranch - Upper Laguna - Lower Laguna	Soundscape Cumulative	No effect No effect	Minor adverse Negligible adverse

5.3.2 Alternatives B and C: Action Alternatives

Under Alternatives B and C heavy equipment would be mobilized to the project areas to conduct culvert replacement and stream channel stabilization activities. While potential treatment actions at Upper Laguna and Lower Laguna differ under Alternatives B and C, the heavy equipment required to implement Alternatives B or C would have the potential to increase noise levels at the project sites and on access roads leading to the project sites, which would degrade natural soundscapes. Best Management Practices outlined in Appendix B of this document describe methods that would be employed to minimize the effects of this noise production on humans and wildlife. Both Action Alternatives have the capacity to impact natural soundscapes to a similar extent; therefore the potential impacts are assessed together.

5.3.2.1 Analysis

Replacement of culvert facilities at the 6 project areas may result in the temporary increase in ambient noise levels at and immediately adjacent to the project areas. Implementation of Alternatives B or C would greatly reduce the potential for catastrophic failures of these 6 crossing structures, and also reduce the need for emergency repairs and cleanings. Earthmoving activities, vehicle movement, and placement of pre-fabricated culvert structures would create noise and vibrations during the construction period. "Operation" of the facilities, once constructed, would not change natural quiet at or adjacent to the sites. During construction, coastal winds at these sites might attenuate sound, reducing potential impacts.

Some of the sites might require small to moderately-sized pilings in order to secure the culvert upgrade structures in the channel. The sites that would require pilings are listed in table 5.7 below. The need for pilings is being determined as a part of the geotechnical investigation and report in progress. Construction activities where pilings would be required would affect natural quiet to a much greater degree. If pilings were necessary at the sites listed below, the NPS would implement Best Management Practices as described in Appendix B of this document to minimize the impacts of pile driving on humans and wildlife.

Table 5.7 Sites that may require installation of pilings

	Alternative A	Alternative B	Alternative C
Mount Vision	No Action	May Require Pilings	May Require Pilings
Estero	No Action	May Require Pilings	May Require Pilings
North Home Ranch	No Action	No Pilings	No Pilings
Home Ranch	No Action	No pilings	No Pilings
Upper Laguna	No Action	May Require Pilings	No Pilings
Lower Laguna	No Action	May Require Pilings	No Pilings

Completion of construction activities at each project site would be limited to either 2 or 3 weeks. Alternatives B and C would be expected to produce localized minor to moderate, short-term, adverse impacts on natural quiet and no long-term impacts.

5.3.2.2 Cumulative Effects

Alternatives B or C might cause cumulative effects on natural quiet, if construction activities take place concurrently with projects listed in Table 4.1 of this document. Projects potentially occurring concurrently are the Coastal Watershed Project – Geomorphic Restoration and Lower Glenbrook Quarry and Dam Restoration. These projects would require heavy equipment use and earthwork, and would have the potential to increase ambient noise levels in the vicinity of the project sites.

Projects would occur during the construction window of August 1-October 31, 2005. Potentially, heavy equipment use could occur simultaneously at 2 close sites. In addition to heavy equipment use at the project areas, increased vehicle and equipment traffic on roads to the project areas could create cumulative noise impacts. However, the construction window for the actions that would potentially overlap would be short, e.g. 3 months. Concurrent work at 2 adjacent project sites would last for no longer than a maximum of 3 weeks. The NPS and its contractors would implement Best Management Practices, outlined in Appendix B of this document to minimize effects of noise on humans and wildlife.

Because of the limited area effected, the NPS BMPs which minimize noise production and its effects, and the relatively short construction period, the Action Alternatives' potential for cumulative effects on natural quiet would be minor, short-term, and adverse. There would be no effect in the long term.

5.3.2.3 Conclusion for Action Alternatives Effects on Soundscapes

Under both Action Alternatives, the potential for cumulative effects on natural quiet would be similar. Impacts would be minimized by Best Management Practices, the relative acoustic isolation of individual project sites and the naturally high ambient noise levels at some project sites. Noise impacts due to incremental effects at each of the 6 project sites considered in this document vary by site and by alternative. Under Alternatives B and C, heavy equipment use would create minor noise impacts at the sites and on access roads during construction activities. At some sites, listed in Table 5.7 above, the potential need to

anchor culvert structures with pilings could create additional noise impacts. At these sites, if pile driving were required, noise impacts would increase to moderate levels for a limited time (1-2 days).

Under the action Alternatives, short-term impacts to natural quiet would be moderate in intensity and adverse. There would be no long-term impacts to natural quiet as a result of implementation of the Action Alternatives.

Implementation of the Action Alternatives (B or C) would not result in impairment of park resources.

Table 5.8 Alternatives B and C: Overall Effects on Soundscapes

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Mount Vision Road	Soundscape	Minor to moderate adverse *	No effect
Estero Road	Cumulative	Minor adverse	No effect
Home Ranch	Soundscape	Minor adverse	No effect
North Home Ranch	Cumulative	Minor adverse	No effect
Upper Laguna	Soundscape	Minor to moderate adverse *	No effect
Lower Laguna	Cumulative	Minor adverse	No effect

* depends on results of geotechnical investigation and potential need for pilings.

5.4 Hydrologic and Geomorphic Processes, including Water Quality

The alternatives described in this section evaluate impacts to hydrologic and geomorphic process, and water quality at 6 culverted road crossing sites. In general, culverts become a stable feature in a stream system, halting hydrologic or geomorphic processes through the facility. As an example, culverts typically concentrate flow, artificially increasing velocity and the erosive capacity of the flowing water. Culverts often mark the point of abrupt change in channel type and stability, affecting not only the physical conditions, but the ecological conditions within a stream system.

Because they act as a stable geomorphic feature, restoration actions must consider how the culvert alters natural process, as well as methods to reconnect the hydraulic and geomorphic processes between upstream and downstream areas. Often this requires additional channel reconfiguration as the geomorphic control is replaced by a more naturally functioning approach.

Additional information regarding these processes, and the design criteria used to evaluate potential actions to replace culverts and restore natural hydrologic and geomorphic process are described in Section 2.2.2.

5.4.1 Alternative A

Under Alternative A, no planned culvert upgrade would take place. As a result, there would be no changes to existing hydrologic or geomorphic processes. As described in Section 3, Project Setting, these road crossings would continue to impede natural hydrologic and geomorphic process, since the culverts act as stable structures and the stream adjusts both upstream and downstream based on its presence. These culverts are documented to restrict natural floodplain and hydrologic process and interrupt natural erosion and deposition.

The condition of these structures, most notably at the Mt. Vision and Estero Road sites, are poor, and potential catastrophic failure would change the already altered stream channel geomorphic condition.

5.4.1.1 Analysis

Because no new earthwork activities would take place, Alternative A would not result in immediate impacts to hydrologic or geomorphic process, or water quality. Impacts to water resources from ongoing maintenance and periodic facility cleaning activities would be long-term and negligible. However, these activities could not effectively mitigate the continuing risks associated with the failing and undersized culverts at the 6 crossing sites.

Factors including age, size, and materials of construction were used to evaluate condition of culvert facilities. In general, metal culverts have a design life of approximately 20-30 years, depending on corrosive factors and erosion of the culvert bottom by bed movement. Cement structures last far longer, and are deemed more structurally stable than the metal equivalents.

The risk of failure is greatest at Mt. Vision, where water has been observed piping around the metal culvert, and Estero Road, where the metal culvert is bowed and compresses under heavy weight. Failure could occur as a result of structural decay or overtopping. In either case, catastrophic failure would mobilize large amounts of sediment and debris, degrading geomorphic condition and water quality. Mobilized bed and bank material, moving downstream at high velocity, could even initiate debris flows with the potential to cause severe downstream channel erosion. Headcutting upstream would likely occur as the bed of the stream adjusts to conditions without the culvert bed control. Furthermore, even if the culverts themselves could withstand high flows, mass wasting events, unrelated to the culvert structures, either upstream or downstream of these crossings, could be greatly exacerbated if they incorporated the crossing sites and caused culvert failures. A failure of the culvert at the Upper Laguna site might cause moderate upstream channel widening. Structures at the remaining crossings could fail under flood conditions, but at their locations in the watershed, impacts would be more localized.

Like impacts described in Section 5.1, the risk of failure due to geohazards or flood flow is high. While the No Action alternative would not likely effect hydrologic and geomorphic processes, or water quality in the short term, the potential for structural failure at one or more sites in the long term would result in the potential for minor to moderate adverse long-term impacts.

5.4.1.2 Cumulative Effects

Under Alternative A, no actions would be taken at any of the 6 sites. Regular ongoing maintenance would result in negligible cumulative short-term impacts. The degraded nature of many of the facilities identified in the project area could result in failure under winter storm conditions, with localized minor to moderate adverse impacts. In the long term, Alternative A would have the potential for minor overall impact as a result of catastrophic failure of one or more of the project crossings.

Alternative A would result in negligible short-term effects, but would lead to the potential for minor long-term adverse cumulative effects to hydrologic and geomorphic processes, and to water quality.

5.4.1.3 Conclusion for No Action Alternative Effects on Hydrologic process, geomorphic process, and water quality

Under Alternative A, there would be negligible short-term impact to hydrologic or geomorphic process, or water quality as a result of routine maintenance of the existing facilities. In the long term, there is potential for minor to moderate long-term adverse impacts under Alternative A. Without replacement, Mt. Vision and Estero Road crossings are at the greatest risk of catastrophic failure, resulting in localized moderate impacts to these resources in the long term. The other sites are lower in the watershed, and the potential for failure is lower, resulting in minor localized adverse long-term impacts. These impacts center on the risk of exacerbated stream channel erosion and the potential for catastrophic culvert failures.

Table 5.9 Alternative A: Overall Effects on Hydrologic process, geomorphic process, and water quality

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Mount Vision Road	Hydrologic Process	Negligible adverse	Moderate adverse
Estero Road	Geomorphic Process	Negligible adverse	Moderate adverse
	Water Quality	Negligible adverse	Moderate adverse
	Cumulative	Negligible adverse	Minor adverse
Home Ranch	Hydrologic Process	Negligible adverse	Minor adverse
North Home Ranch	Geomorphic Process	Negligible adverse	Minor adverse

	Water Quality	Negligible adverse	Minor adverse
	Cumulative	Negligible adverse	Minor adverse
Upper Laguna	Hydrologic Process	Negligible adverse	Minor adverse
Lower Laguna	Geomorphic Process	Negligible adverse	Minor adverse
	Water Quality	Negligible adverse	Minor adverse
	Cumulative	Negligible adverse	Minor adverse

Implementation of Alternative A would not result in impairment of park hydrologic process, geomorphic process, or water quality.

5.4.2 Alternative B

Treatments proposed under Alternative B are described in Section 2. Construction would require excavation and manipulation of the streambed and banks at road crossing locations. Installation of stream diversions to transfer clean water from above to below would occur prior to construction activities at each project area. The methods for diverting water are described in Section 2, and are meant to maintain stream conditions above and below the site, would isolate construction and avoid water quality impacts. Within the diversion area, aquatic species would be removed through seining and electrofishing, and relocated downstream to suitable habitat (See Section 5.6).

Heavy equipment, including excavators (all sites), cranes (all but North Home Ranch), loader, and dump truck (all sites) would be required for operations. Staging for this equipment would occur on previously disturbed surfaces where possible, such as roads and parking lots. At some sites additional space might be needed. This could disturb up to 0.5 acres of land at each site. Best Management Practices, outlined in Appendix B of this document, will be employed to minimize soil disturbance during construction activities; these include wetting of soils to prevent destabilization of fine particles, and revegetation immediately after disturbance.

Mt Vision and Estero Road Crossings
At Mt. Vision and Estero Road crossings, the culverts are set above grade with a vertical disconnect of 4 feet (Estero Road) to 7 feet (Mt. Vision Road) in the stream profile. Because the stream channel profile and habitat has developed with the existing culvert grade control, restoration actions propose installation of boulder cross-vanes to provide grade control and step the stream up through the new culvert or arch facility. Installation of these cross-vane structures would include excavation of the channel areas and placement of boulders (fill) following appropriate design specifications. In general, vertical gain for each cross-vane would be one foot, and the spacing between the structures would be at least one bankfull width. The boulder structures are intended to adjust gradually and function as part of the stream system. In order to insure that downcutting does not destabilize the foundation of the new road crossing structure, the design at these 2 sites also includes a cement sill at the downstream end of the structure. The sill would be integrated into the cross vane steps and their function. The restored reach would include a natural gravel bed through the structure, and a step-pool channel type supporting aquatic passage through the site.

North Home Ranch and Home Ranch Creek crossings
At North Home Ranch, and Home Ranch project sites, the culverts are at grade, but undersized, to convey potential flood flows through the site. Installation of more durable structures would allow greater flow conveyance, as well as reduce long-term maintenance requirements. Added conveyance would prevent ponding on the upstream side of the culvert, thereby reducing flooding potential.

Upper Laguna and Lower Laguna crossings
Unlike the other project sites, where the channel is typically wide and shallow above the culvert, and narrower and incised downstream, the Upper Laguna site actually shows the opposite configuration. The existing culvert is a transition between a deep incised stream channel and a wide, meandering channel and floodplain. Removal of the culvert and replacement with a bridge would require riprap armoring to prevent uncontrolled widening and erosion upstream to match the current downstream conditions.

The Lower Laguna site contains a cement culvert set below the existing channel and floodplain grade. The culvert is a part of a road crossing perpendicular to the valley and floodplain, which has shown large-scale sediment deposition since the 1995 Mt. Vision Fire. The proposed bridge would allow for a 30-foot span and would support more natural floodplain process and channel function.

5.4.2.1 Analysis

Hydrologic and Geomorphic Process

Mount Vision and Estero Road Crossing
Construction activities would require excavation and placement of fill in association with each road crossing. These activities would be most expansive at Mt. Vision and Estero Road crossings where boulder cross-vanes would be integrated into the stream profile stabilization and fish passage restoration. At each of these sites, channel alterations would occur approximately 100 feet upstream and downstream of the existing crossing. Steep or unstable streambanks would be excavated and reshaped to a more stable grade. Boulder cross-vanes would be installed by excavator from the bed of the channel, within the existing project footprint. Steep and narrow channel conditions would prevent installation from the terrace areas.

The installation of arch culvert or box culverts at these sites would require the installation of a cement sill at the downstream end to prevent downcutting up to and through the culvert structure. The sill would also insure the presence of natural gravel bed in the box culvert. Boulder cross-vanes would be required to accommodate the 7-foot (Mt Vision) and 4-foot (Estero Road) stream profile elevation differences within the project area. Boulder cross-vanes have previously been installed to slow the rate of upstream incision at Muddy Hollow and Cheda Creek. In addition, boulder weirs have been used successfully to restore fish passage at the John West Fork of Olema Creek.

The actions required at each of these sites are intended to restore natural hydrologic and geomorphic process through the road crossing facility. Localized moderate impacts would be short-term and adverse. In the year following and throughout the long term, the project would result in moderate beneficial effects to hydrologic and geomorphic process at these sites and within the project area.

North Home Ranch and Home Ranch
At these two project sites, the culverts are installed at grade in low-grade areas where the streambed remains in stable condition. The installation of an oversized box culvert at North Home Ranch, and a 3-sided bridge at Home Ranch would result in increased flow conveyance, would maintain bed stability, and would reduce overtopping frequency at these sites. Installation of the stream bypass prior to construction would allow operations from the most optimal location, and for limited temporary crossing availability for ranch residents and rangeland lessees.

The Home Ranch site is located within the historic complex, adjacent to the historic house and barns. The most confined area of the stream channel is actually 50-100 feet upstream of the crossing, between the main house and cattle barn. The proposed project would include excavation of a bankfull bench to accommodate greater flow through the channel constriction and reduce localized flooding at the home site. This excavation would alter the geomorphic function of the channel, but reduction in flooding, and reduced site velocities would be beneficial at the site. This work would not entail excavation or alteration of the channel itself. Work would be conducted from the flood terrace and would not result in additional wetland fill.

It is expected that construction at each site would require 2 to 3 weeks to complete. Because the proposed actions would restore more natural hydrologic and geomorphic process, and the construction would not require limited activities within the bed either upstream or downstream of the project sites, the actions would result in short-term minor adverse impacts, but beneficial long-term effects.

Upper Laguna and Lower Laguna

These 2 project sites are located within the Laguna Creek watershed, at low-grade areas of the watershed. At the Upper Laguna site, the culvert is the transition between a narrow, deeply incised stream channel to a more open meandering system connected to a floodplain. The Lower Laguna crossing is located downstream in a highly depositional area of the floodplain.

Under Alternative B, installation of a 30-foot bridge crossing at Upper Laguna would likely result in channel widening and erosion upstream of the road crossing. Because the upstream area is confined by road and minor development (park residences and Clem Miller Education Center), this type of action would likely require bank stabilization. At the bridge crossing, the channel would be armored with riprap, and monitoring would be required to insure that channel expansion did not continue upstream. There is a 3-foot vertical difference between the bed of the creek through the project area. This vertical difference would require installation of 3 boulder cross-vane structures to insure against upstream headcutting and increased instability. This action would result in moderate short-term adverse impacts to the hydrologic and geomorphic process. It is likely that this site would stabilize in the long term; however, the configuration of the channel upstream is such that potential for minor adverse effects could persist as a result of this project.

The Lower Laguna site is located in an active floodplain and depositional area. The culvert is part of a 300-foot long road embankment crossing the entire active floodplain. This entire facility impinges on natural hydrologic and geomorphic process. The current culvert is installed approximately 3 feet below existing grade and is subject to high-velocity scour on a regular basis. Alternative B proposes replacement of the culvert with a 30-foot span bridge. This action would accommodate more natural flow conditions, but would not alleviate the impediment that the entire road embankment causes on this active and dynamic floodplain. The installation of this bridge structure would likely perpetuate effects on the channel and floodplain processes. Installation of the bridge structure would result in minor short-term impacts as the channel and floodplain readjust to the wider, excavated crossing, but in the long term, this would result in a benefit to hydrologic and geomorphic processes at the Lower Laguna crossing.

Water Quality
At the project sites, the mechanisms and potential for water quality impacts will be similar. Because preparation would include the installation of a stream bypass system prior to construction, the project area will be isolated, and clean water will be maintained downstream of the project area. It is expected that within the project area, conditions will remain saturated, but there will be very little to no flow through the site.

As part of the environmental commitments, contractors would be required to operate with a pollution prevention plan and have a means of minimizing the potential impacts of equipment failure or leakage. At each site, contractors would establish an equipment holding area where overnight storage and refueling will occur. These areas would be located away from the creek and are intended to reduce potential of accidental spills to the sensitive resource areas.

Following construction, potential short-term effects (during the first winter season) could occur as a result of sediment runoff and readjustment prior to natural revegetation. The installation of erosion control practices will mitigate the potential sediment mobilization and runoff to some degree, but will not prevent fine colloidal particles from entering the stream channel during rainfall.

At the project sites, the construction BMPs are developed to limit potential water quality impacts during and after construction. As a result, the effects on water quality are described as short-term adverse and minor, and would result in no effect in the long term.

5.4.2.2 Cumulative Effects

The Fire Management Plan and Environmental Impact Statement propose the use of prescribed fire in the Estero Fire Management Unit (FMU). This FMU incorporates the Estero, North Home Ranch, and Home Ranch crossings. Planning level mitigation in the fire plan will insure that, while the FMUs may cover more than 10% of any one watershed, activities in any given year will be limited to less than that 10%

threshold. In cases where this is exceeded, additional mitigation to reduce sediment runoff from the burn areas would be instituted. In this manner, watershed scale effects associated with burning would be limited.

This project would likely occur concurrently with the Coastal Watershed Restoration – Geomorphic restoration project and potentially with the Lower Glenbrook Dam and Quarry Restoration project. The impacts associated with the culvert replacement projects will remain localized and would not likely change or magnify the cumulative impacts within the Drakes Bay area.

The project will result in minor adverse cumulative short-term and beneficial long-term effects to hydrologic processes, geomorphic processes, and water quality.

5.4.2.3 Conclusion for Alternative B Effects on Hydrologic process, geomorphic process, and water quality

The potential impacts associated with implementation of Alternative B on hydrologic process, geomorphic process, and water quality are adverse, and minor to moderate in the short term. Short-term impacts include excavation of stream channel banks and beds, soil compaction and erosion due to heavy equipment traffic. Localized moderate impacts would result from installation of boulder cross-vanes or large-scale riprap armoring along with structure replacement. The restoration of more natural hydrologic and geomorphic process to these watersheds would be beneficial in the long term. In the long term, there would be no effect on water quality.

Table 5.10 Alternative B: Overall Effects on Hydrologic process, geomorphic process, and water quality

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Mount Vision Road	Hydrologic Process	Moderate adverse	Beneficial
Estero Road	Geomorphic Process	Moderate adverse	Beneficial
	Water Quality	Minor adverse	No effect
	Cumulative	Minor adverse	Beneficial
Home Ranch	Hydrologic Process	Minor adverse	Beneficial
North Home Ranch	Geomorphic Process	Minor adverse	Beneficial
	Water Quality	Minor adverse	No effect
	Cumulative	Minor adverse	Beneficial
Upper Laguna	Hydrologic Process	Moderate adverse	Minor adverse
	Geomorphic Process	Moderate adverse	Minor adverse
	Water Quality	Minor adverse	No effect
	Cumulative	Minor adverse	Beneficial
Lower Laguna	Hydrologic Process	Minor adverse	Beneficial
	Geomorphic Process	Minor adverse	Beneficial
	Water Quality	Minor adverse	No effect
	Cumulative	Minor adverse	Beneficial

Implementation of Alternative B would not result in impairment of park hydrologic processes, geomorphic processes, or water quality resources.

5.4.3 Alternative C

Alternative C is identical to Alternative B for the Mount Vision, Estero, Home Ranch, and North Home Ranch crossings. Impacts associated with proposed construction activities at these sites are evaluated above in section 5.1.2. Alternative C differs from Alternative B at Upper and Lower Laguna crossings. At Upper Laguna Crossing, Alternative C proposes repair and stabilization of the sack concrete culvert headwall, and installation of 3 boulder structures in the creek bed to retard streambed erosion. At Lower Laguna crossing, Alternative C proposes installation of either a corrugated metal pipe arch, or a 12-foot by 8-foot concrete box culvert.

These alternatives would require the employment of heavy equipment, including excavators, cranes, and pick-up trucks. Staging for this equipment would occur on previously disturbed surfaces where possible, such as roads and parking lots. At some sites, additional space might be needed. This might disturb up to 0.5 acres of land at each site. Best Management Practices, outlined in Appendix B of this document, would be employed to minimize soil disturbance during construction activities; these would include wetting of soils to prevent destabilization of fine particles, and revegetation immediately after disturbance.

At the Lower Laguna crossing the structure constructed under Alternative C would be either a corrugated metal arch or a concrete box culvert. The structure would be determined through the results of a geotechnical investigation of the site, currently in progress. Either of these options would produce similar impacts, evaluated in this section.

5.4.3.1 Analysis

Hydrologic and Geomorphic Process

Mount Vision and Estero Road Crossing
Incremental effects under Alternative C at these 2 sites would be the same as those described in Alternative B, Section 5.1.2.1.

North Home Ranch and Home Ranch
Incremental effects under Alternative C at these 2 sites would be the same as those described in Alternative B, Section 5.1.2.1.

Upper Laguna and Lower Laguna
These 2 project sites are located within the Laguna Creek watershed, at low-grade areas of the watershed. At the Upper Laguna site, the culvert is the transition between a narrow, deeply incised stream channel and more open, meandering system, connected to a floodplain. The Lower Laguna crossing is located downstream in a highly depositional area of the floodplain.

Under Alternative C, the existing culvert facility, documented to pass the 100-year discharge and acting as a stable geomorphic feature, would remain. Installation of boulder cross-vanes downstream, and repair of the existing headwall, would be completed as part of the project. The installation of the cross-vanes would step the creek up into the mouth of the culvert, effectively reducing velocities at the outlet of the culvert and allowing for adult and juvenile fish passage. In addition, the cross-vanes would preserve the historic footings remaining from a previous bridge, immediately downstream of the crossing. The pre-design evaluation determined that the culvert was in good condition, and with minor repairs, would meet project design criteria.

The installation of boulder cross-vanes would reduce the localized grade and velocity impediments to fish passage through the site. While seeming to contradict most restoration planning, leaving the current structure in place would actually protect against large-scale channel widening and erosion. This action would result in minor short-term adverse impacts to the hydrologic and geomorphic processes. It is likely that this site would stabilize in the long term, and remain in a condition very similar to the current condition. As a result, in the long term, there would likely be no effect.

The Lower Laguna site is located in an active floodplain and depositional area. The culvert is part of a 300-foot long road embankment crossing the entire active floodplain. This entire facility impinges on natural hydrologic and geomorphic processes. The current culvert is installed approximately 3 feet below existing grade and is subject to high-velocity scour on a regular basis. Alternative C proposes installation of a metal arch or cement box culvert that would accommodate more than double the current conveyance capacity. This action would accommodate more natural flow conditions, but would not alleviate the impediment on this dynamic floodplain caused by the entire road embankment. The installation of the proposed structure would permit future consideration of other alternatives to the existing road/trail

alignment including road/trail reroute, to protect the floodplain integrity. Installation of the culvert structure would result in minor short-term impacts as the channel and floodplain readjusted to the wider, excavated crossing. In the long term, the action would result in a benefit to hydrologic and geomorphic processes at the Lower Laguna crossing.

Water Quality
Incremental effects to water quality under Alternative C at project sites would be the same as those described in Alternative B, Section 5.1.2.1.

At the project sites, the construction BMPs are developed to limit potential water quality impacts during and after construction. As a result, the effects on water quality are described as short-term adverse and minor, and would result in no effect in the long term.

5.4.3.2 Cumulative Effects

The potential for cumulative impacts under Alternative C are the same as those described for Alternative B, Section 5.4.2.2. The project will result in minor adverse cumulative short-term and beneficial long-term effects to hydrologic process, geomorphic process, and water quality.

5.4.3.3 Conclusion for Alternative C Effects on Hydrologic process, geomorphic processes, and water quality

The potential impacts associated with implementation of Alternative C on hydrologic processes, geomorphic processes, and water quality are adverse, and minor to moderate in the short term. Short-term impacts include excavation of stream channel banks and beds, soil compaction and erosion due to heavy equipment traffic. Localized moderate impacts at sites would include installation of boulder cross-vanes or large-scale riprap armoring along with structure replacement. The restoration of more natural hydrologic and geomorphic processes to these watersheds would be beneficial in the long term. In the long term, there would be no effect on water quality.

Table 5.11 Alternative C: Overall Effects on Hydrologic process, geomorphic process, and water quality

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Mount Vision Road	Hydrologic Process	Moderate adverse	Beneficial
Estero Road	Geomorphic Process	Moderate adverse	Beneficial
	Water Quality	Minor adverse	No effect
	Cumulative	Minor adverse	Beneficial
Home Ranch	Hydrologic Process	Minor adverse	Beneficial
North Home Ranch	Geomorphic Process	Minor adverse	Beneficial
	Water Quality	Minor adverse	No effect
	Cumulative	Minor adverse	Beneficial
Upper Laguna	Hydrologic Process	Minor adverse	No effect
	Geomorphic Process	Minor adverse	No effect
	Water Quality	Minor adverse	No effect
	Cumulative	Minor adverse	Beneficial
Lower Laguna	Hydrologic Process	Minor adverse	Beneficial
	Geomorphic Process	Minor adverse	Beneficial
	Water Quality	Minor adverse	No effect
	Cumulative	Minor adverse	Beneficial

Implementation of Alternative C would not result in impairment of park hydrologic processes, geomorphic processes, or water quality resources.

5.5 Impacts to floodplains, wetlands, and riparian zones

Floodplains, wetlands, and riparian zones have the potential to be both positively and negatively affected by replacement of stream crossing infrastructure. The effects on floodplains, wetlands, and riparian zones result not only from the immediate impacts of excavation, infrastructure placement, construction equipment use and staging, but long-term impacts from changes in stream course, streamflow velocity, duration and extent of inundation, sedimentation and erosional patterns, etc. Indirect effects may be delayed , incremental and may be highly correlated with the degree of change inherent in each of the proposed actions. The impacts resulting from the proposed actions must be placed in the context of the watershed's constant state of flux from ongoing and past watershed disturbances and other factors, such as the Mt. Vision fire, historic logging and agricultural activities, climatic patterns, etc.

While construction-related impacts to floodplains and aquatic habitats can be assessed quantitatively, some of the indirect impacts and impacts associated with existing management and maintenance regimes can only be evaluated qualitatively. Because of differences in the extent of wetlands regulated by different agencies, two different sets of numbers are presented to quantify wetland and riparian impacts from fill and/or excavation, and tree removal.

5.5.1 Alternative A: No Action

This alternative continues the current routine maintenance and management of existing crossing facilities.

5.5.1.1 Analysis

This analysis focuses on continuation of routine maintenance and management of existing facilities at the 6 crossings.

Potential impacts to floodplains, wetlands, and riparian zones would differ slightly depending on the project site. Most of these project sites have already adjusted to existing infrastructure conditions and constraints and appear to be relatively stable in terms of the quantity and quality of floodplains, wetlands, and riparian zones. No long-term impacts would be expected due to the current infrastructure or other trends in subwatershed conditions. In addition, the project sites do not support populations of special status or rare plant species or invasive, non-native species that could be impacted either positively or negatively by existing routine maintenance and management.

Where existing infrastructure remains in "fair" to "good" condition (NHC 2002), the potential for catastrophic failure appears low; therefore, impacts would be primarily associated with current routine maintenance and management and would be negligible to minor, and adverse in the long term. Project sites with infrastructure in "fair" to "good" condition include Home Ranch, North Home Ranch, Upper Laguna, and Lower Laguna. Routine maintenance of crossing facilities could impact floodplain, wetlands, and riparian habitat immediately adjacent to the culvert, but the impact would be highly localized and would be considered negligible and adverse in the short and long term. The frequency of maintenance and repair under Alternative A would be higher than under the other alternatives. In addition, these habitats would likely regenerate quickly, thereby ensuring that at least some of the impacts – particularly to herbaceous wetland communities -- would be only short-term in nature. Mature riparian communities such as willow and alder forests would regenerate quickly, but would require a much longer time to return to pre-construction conditions. Because of the nearby ranch and horticultural plantings, most of the "riparian" zone within the project area at Home Ranch Creek currently consists of non-native, ornamental species.

Mount Vision and Estero Road Crossings

The potential for catastrophic failure at Estero Road and Mt. Vision Road is much higher, because the existing infrastructure is in "poor" condition (NHC 2002). In addition, the discontinuity in channel condition between upstream and downstream portions is much greater than in the other project areas and, therefore, there is a higher potential for impacts to floodplains, wetlands, and riparian habitat (adverse, long-term, and moderate). At Estero and Mt. Vision Roads, the upstream portions of East Schooner Creek are approximately 3- to 5 feet higher than the downstream portions, respectively, and the culverts appear to be acting as grade controls (NHC 2002). Because of the infrastructure, floodplains upstream of the culvert are much wider than those downstream, and the downstream portion of the creek is incised or entrenched,

with very steep creek banks that have minimized development of floodplains, wetlands, and/or riparian habitat. In addition, both project areas have drainage swales or existing gullies located near the culverts. Should the infrastructure fail, a strong possibility given their "poor" condition, the upstream portions of the channel might adjust to downstream elevations by eroding, thereby directly causing a loss of upstream floodplains and streamside riparian habitat. Channel erosion would probably extend into the drainage swales and existing gullies, thereby causing a loss of wetlands and riparian habitat in these areas as well. Riparian areas adjacent to the portions of East Schooner Creek, upstream of the culverts, are not Section 404 jurisdictional wetlands, but are potentially subject to oversight by the CCC and the NPS. Headcutting could increase the vertical distance between the upstream floodplain terraces and stream channel bottoms, promoting a transition to a more drought-tolerant riparian habitat dominated by box elder (*Acer negundo*) or even oaks (*Quercus* spp.). Conversion from arroyo willow and red alders (*Alnus rubra*) to oak would decrease the amount of wetlands subject to oversight by the CCC and the NPS.

Home Ranch and North Home Ranch
At North Home Ranch Creek, there is some potential for headcutting or upstream erosion should the culverts, rated as being in "fair" condition, fail. While the stream channel upstream of the culvert is relatively shallow (5 feet deep), the stream channel a short distance farther upstream deepens to 15 feet (NHC 2002). The elevation difference has probably been created by increased sedimentation near the culvert from backwater flooding caused by the undersized culvert. Should the culvert fail, the channel just upstream of the culvert would likely adjust to elevations farther upstream by incising or eroding downwards, thereby causing direct impacts to Section 404 jurisdictional waters and wetlands. Headcutting would likely continue until it reached a natural grade control 2,000 feet upstream of the crossing. Riparian areas adjacent to the upstream portion of North Home Ranch Creek are not Section 404 jurisdictional wetlands, but are potentially subject to oversight by the CCC and the NPS. As headcutting would increase the vertical distance between the floodplain terrace and the stream channel bottom, dominant riparian species on these floodplain terraces might eventually transition from arroyo willow (*Salix lasiolepis*) to species tolerant of dryer conditions or greater depths to the water table such as box elder (*Acer negundo*) or even oaks (*Quercus* spp.). Conversion from arroyo willow to oak would decrease the amount of wetlands subject to oversight by the CCC and the NPS.

There are no appreciable drops in elevation between the upstream and downstream portions of the creek at the Home Ranch, so failure would not necessarily result in initiation of headcutting or channel erosion that would impact floodplains and associated wetlands and riparian zones.

Upper Laguna and Lower Laguna
Should culverts fail, there is also potential for headcutting or upstream erosion at the Upper Laguna project area, although these culverts are considered to be in "good" condition. The portion of Laguna Creek upstream of the culvert is approximately 1- to 2-feet higher than the downstream portion, and, therefore, the culverts appear to be acting as a grade control (NHC 2002). In addition, bank failures have been observed upstream of the culvert (NHC 2002). Should the culverts fail, the upstream portion of the channel might adjust to downstream elevations by eroding, and bank failures or bank erosion could increase, thereby causing a widening in upstream floodplains and a loss of riparian habitat.

There are no appreciable drops in elevation between the upstream and downstream portions of the creek at the Lower Laguna project areas, so failure would not necessarily result in initiation of headcutting or channel erosion that would impact floodplains and associated wetlands and riparian zones.

5.5.1.2 Cumulative Impacts

Based on an analysis of the list of projects in Chapter 1, the cumulative impacts of the projects listed with this proposed action would have a negligible effect on floodplain, wetlands, and riparian zones in the park. The projects that could potentially cause impacts, in conjunction with existing operation and management of the crossing infrastructure, would be the Horseshoe Pond Restoration Project, Coastal Watershed Enhancement Project – Geomorphic Restoration, and Glenbrook Dam and Quarry Restoration Project. In general, the above restoration projects would have beneficial effects on floodplains and wetlands. There

could be some negative short-term and long-term impacts to riparian zones associated with the Muddy Hollow and Glenbrook Creek components of the Coastal Watershed Enhancement Project, however, the overall effect to park riparian resources would be negligible.

5.5.1.3 Conclusion

The overall effects of Alternative A or No Action on floodplains, wetlands, and riparian zones are shown in Table 5.12 below. The current routine maintenance and management of existing crossing facilities would, in general, potentially have adverse, long-term effects on these natural resources, ranging from negligible to moderate in magnitude. Most of the floodplain, wetland, and riparian zone conditions at the project sites are relatively stable. Consequently, most of the potential impacts would result from failure of existing structures, particularly at sites in which the infrastructure condition is rated as "poor" to "fair" and where stream channel conditions are poor (e.g., large differences between upstream and downstream channel elevations). There would also be some potential for impact from future repair and maintenance of structures.

Under Alternative A, the no effect to floodplains, wetland, or riparian zones would occur as a result of direct activities. The long-term potential for structures to fail would result in minor to moderate impacts in the long term.

The proposed actions would not result in long-term impairment to floodplain, wetland, and riparian zone resources.

Table 5.12 Alternative A: Overall Effects on Floodplains, Wetlands, and Riparian Zones

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Mount Vision Road	Floodplains	Negligible adverse	Moderate adverse
Estero Road	Wetlands	Negligible adverse	Moderate adverse
	Riparian	Negligible adverse	Moderate adverse
	Cumulative	No effect	Minor adverse
Home Ranch	Floodplains	Negligible adverse	Minor adverse
North Home Ranch	Wetlands	Negligible adverse	Minor adverse
	Riparian	Negligible adverse	Minor adverse
	Cumulative	No effect	Minor adverse
Upper Laguna	Floodplains	Negligible adverse	Minor adverse
Lower Laguna	Wetlands	Negligible adverse	Minor adverse
	Riparian	Negligible adverse	Minor adverse
	Cumulative	No effect	Minor adverse

5.5.2 Alternative B: Restore Fish Passage and Minimize Future Maintenance Needs

Alternative B involves the replacement of existing infrastructure to restore fish passage and minimize future maintenance needs. Alternatives B and C propose the same action for Mt. Vision Road, Estero Road, North Home Ranch, and Home Ranch crossings. Therefore, Alternatives B and C have certain elements in common, including BMPs that would be used during construction of the action alternatives.
In addition, under Alternative B, installation of prefabricated steel bridges at the Upper and Lower Laguna project areas is considered.

5.5.2.1 Analysis

Direct, quantifiable impacts associated with the proposed actions include fill, excavation, and selective removal of trees associated with infrastructure construction (Table 5.15). Indirect impacts could occur as a result of geomorphic and hydrologic changes in the creeks following installation of new infrastructure, but

these may not be as easy to define or quantify. BMPs have been established as mitigation measures and are intended to reduce some of the construction impacts that are not related to the actual installation of new infrastructure (beneficial, short to long-term, negligible to minor). For example, the potential for construction equipment to increase the areal extent of invasive, non-native species would be minimized by ensuring that construction equipment is cleaned prior moving in the project areas (beneficial, long-term, and minor). Currently, there are no special status plant species or invasive, non-native species within the project areas that could be affected by the proposed actions (no effect).

The proposed actions could decrease upstream floodplain widths in project sites where undersized culverts have created a backwater flooding effect. Backwater flooding increases sedimentation and creates unnaturally wide floodplains. In incised portions of creek channels where grade control structures would be installed, such as North Home Ranch, Estero Road, and Mt. Vision Road, the proposed actions may actually have a beneficial impact on floodplains by elevating portions of the channel bottom that have become entrenched through excessive erosion. The proposed actions could slightly decrease upstream floodplain widths in the Lower Laguna project area, where an undersized culvert may have created a backwater flooding effect. But there would likely be no net changes in floodplain dimensions at the Upper Laguna crossing, which already conveys a 100-year flow and does not have an undersized culvert.

Construction-associated fill impacts to wetlands subject to oversight by the Corps, CCC, or the NPS would be negligible within the project sites except for Upper Laguna where the impacts would be minor. Fill impacts to Corps' jurisdictional wetlands and waters would range from 0.002 acres at North Home Ranch to 0.010 acres at Estero Road. Fill impacts to wetlands potentially subject to CCC or NPS oversight range from 0.005 acres at Lower Laguna to 0.019 acres at Estero Road. Construction-related excavation impacts to wetlands subject to oversight by the CCC and the NPS would vary depending on the project area. Excavation impacts would range from adverse, short-term, and negligible impacts on an unconsolidated palustrine streambed at Home Ranch (0.002 acres) to adverse, long-term, and minor impacts on palustrine forested and scrub-shrub wetlands at Mt. Vision Road (0.091 acres). Total excavation, fill, and tree removal impacts to riparian habitat ranged from 0.003 acres of non-native, ornamental riparian species at Home Ranch (adverse, long-term, and negligible) to 0.101 acres of native riparian forests and scrub at Mt. Vision Road (adverse, long-term, and minor). Excavation and removal activities would eliminate established riparian habitat. However, these areas would reestablish the density and height of existing vegetation, over 2 or more years, through available seed and vegetative fragment sources. Permanent impacts to wetlands and riparian zones, consequently, would be limited to construction-associated fill activities and long-term changes or evolution in stream conditions.

The floodplains changes discussed above could have indirect impacts on riparian zones as well. Floodplains narrowing, upstream of culverts, could negatively impact riparian habitat and lead to some species changes. However, it is unlikely that these areas would change from riparian to more drought-tolerant communities (adverse, long-term, and negligible). In entrenched or incised areas, grade control structures that increase the potential for wider floodplains by elevating the stream channel bed, could increase the expansion of riparian habitat (beneficial, long-term, and negligible).

Should there be a need to maintain or repair the new infrastructure, impacts to floodplains, wetlands, and riparian zones could occur. However, the need for and frequency of repair and maintenance would be much less than under Alternative A (consequently - adverse, long-term, and negligible).

5.5.2.2 Cumulative Impacts

Based on an analysis of the list of projects in Chapter 1, the cumulative impacts of the projects listed with these proposed actions would result in isolated effects. The projects that could potentially cause impacts in conjunction with existing operation and management of the crossing infrastructure would be the Horseshoe Pond Restoration Project, Coastal Watershed Enhancement Project – Geomorphic Restoration, and Glenbrook Dam and Quarry Restoration Project. In general, the above restoration projects would have beneficial effects on floodplains and wetlands. While effects of individual projects would remain localized, the cumulative effects to wetlands, floodplains and riparian areas are considered minor in the short term, but beneficial to these systems in the long term.

5.5.2.3 Conclusion

The overall effects of the proposed actions on floodplains, wetlands, and riparian zones are shown in Table 5.15 below. The proposed actions would, in general, have only negligible long-term impacts on floodplains, wetlands, and riparian zones associated with construction-related fill activities and subsequent changes in stream channel conditions. While riparian areas impacted by excavation and tree removal would take more than 2 years to recover to pre-construction conditions, the proximity of seed and vegetative fragment sources would ensure that these impacts would not be permanent. There would also be some potential for impact from future repair and maintenance of structures, but the need for and frequency of maintenance and repair would be less than in Alternative A.

The proposed actions would not result in long-term impairment to floodplain, wetland, and riparian zone resources.

Table 5.13 Alternative B: Overall Effects on Floodplains, Wetlands, and Riparian Zones

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Mount Vision Road	Floodplains	Negligible adverse	Beneficial
Estero Road	Wetlands	Minor adverse	Beneficial
	Riparian	Minor adverse	Beneficial
	Cumulative	Minor adverse	Beneficial
Home Ranch	Floodplains	Negligible adverse	Beneficial
North Home Ranch	Wetlands	Negligible adverse	Beneficial
	Riparian	Negligible adverse	Beneficial
	Cumulative	Minor adverse	Beneficial
Upper Laguna*	Floodplains	Negligible adverse	Beneficial
Lower Laguna	Wetlands	Negligible to Minor* adverse	Beneficial
	Riparian	Negligible adverse	Beneficial
	Cumulative	Minor adverse	Beneficial

*Minor at Upper Laguna

5.5.3 Alternative C: Restore Fish Passage and Maximize Long-Term Management Flexibility

Alternative C evaluates actions at Upper and Lower Laguna sites that meet fish passage enhancement and long-term maintenance criteria, while maximizing long-term management flexibility at these 2 sites. At Upper Laguna, the existing culverts would be retained and stabilized, and boulder grade-control structures would be installed to improve fish passage. At Lower Laguna, the existing culverts would be replaced with metal pipe arch or concrete box culverts. Treatments under Alternative C for the other 4 project areas are the same as evaluated under Alternative B.

5.5.3.1 Analysis

The impacts of this alternative on floodplains, wetlands, and riparian zones at 5 project sites, Mt. Vision Road, Estero Road, North Home Ranch, and Upper Laguna project area are identical to those discussed under Alternative B.

Changes to floodplains under Alternative C at the Lower Laguna project area would be less than under Alternative B, although they would be still be negligible (adverse, and long-term). Differences between the alternatives relate to differences in the modeled flow conveyance under Alternative B (100-year) versus Alternative C (10-year) (NHC 2002). The metal pipe arch or concrete box culverts could still create a backwater flooding effect and maintain the unnaturally wide floodplains that currently exist.

Fill impacts to wetlands subject to oversight by the Corps, CCC, and NPS would be less under Alternative C than Alternative B (see Table 5.15). There would be no excavation impacts to wetlands at Lower Laguna either under Alternative B or C. There would be no impacts to riparian habitat from fill, excavation, and

tree removal under Alternative C (0 acre) unlike Alternative B (0.003 acre). While the frequency of maintenance might be less under Alternative C than Alternative A, it would still probably be higher than under Alternative B. This maintenance frequency could slightly increase the potential for impacts to wetlands and riparian habitat. Still, the potential for impacts associated with infrastructure repair and maintenance would still be negligible in the long term.

5.5.3.2 Cumulative Impacts

The cumulative impacts of this alternative are the same as those discussed for Alternative B. The overall cumulative effect to park riparian resources under Alternative C would be negligible and adverse in the long term.

5.5.3.3 Conclusion

The overall effects of the proposed actions on floodplains, wetlands, and riparian zones are listed in Table 5.14. The overall effects of Alternative C, except at lower Laguna, are the same as those discussed for Alternative B. At Lower Laguna, the proposed actions would have slightly less impact on floodplains and wetlands relative to Alternative B, although impacts would still be characterized as adverse and negligible in the long term. There would be no impact on riparian resources under Alternative C relative to a negligible impact under Alternative B.

The potential for impact from future repair and maintenance of structures might be slightly higher under Alternative C, but still lower than under Alternative A.

The proposed actions would not result in long-term impairment to floodplain, wetland, and riparian zone resources.

Table 5.14 Alternative C: Overall Effects on Floodplains, Wetlands, and Riparian Zones

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Mount Vision Road	Floodplains	Negligible adverse	Beneficial
Estero Road	Wetlands	Minor adverse	Beneficial
	Riparian	Minor adverse	Beneficial
	Cumulative	Minor adverse	Beneficial
Home Ranch	Floodplains	Negligible adverse	Beneficial
North Home Ranch	Wetlands	Negligible adverse	Beneficial
	Riparian	Negligible adverse	Beneficial
	Cumulative	Minor adverse	Beneficial
Upper Laguna*	Floodplains	Negligible adverse	Beneficial
Lower Laguna	Wetlands	Negligible to Minor* adverse	Beneficial
	Riparian	Negligible adverse	Beneficial
	Cumulative	Minor adverse	Beneficial

*Minor at Upper Laguna

TABLE 5.15 Impacts associated with Drakes Estero Watershed Culvert Replacement Action Alternatives.

	SECTION 404 Corps		COASTAL ACT/NPS DIRECTOR'S ORDER										RIPARIAN HABITAT		
			FILL IMPACTS						EXCAVATION IMPACTS			TOTAL IM-PACTS			
Project Area/ Alternative	**Waters**	**Wetlands**	**PFO**	**PSS**	**PUB**	**PCB**	**PEM**	**TOTAL**	**PFO**	**PSS**	**PUB**		**TREE RE-MOVAL**	**NO. TREES**	**TOTAL LOSS**
HOME RANCH															
Alternatives B/C	**0.006**	**0**	0	0.003	0.001	0.003	0	**0.007**	0	0	0.002	**0.009**	0	0	**0.003**
NORTH HOME RANCH															
Alternatives B/C	**0.002**	**0**	<0.001	0.006	0	0.001	0	**0.007**	0	0	0	**0.007**	0.001	1	**0.007**
ESTERO															
Alternatives B/C	**0.010**	**0**	0.010	0.007	0	0.002	0	**0.019**	0.018	0.043	0	**0.080**	0.005	7	**0.082**
MT. VISION															
Alternatives B/C	**0.006**	**0.002**	0.002	0.005	0.003	0.002	0.001	**0.012**	0.056	0.035	0	**0.104**	0.002	4	**0.101**
UPPER LAGUNA															
Alternative B	**0.006**	**0**	0.010	0	0	0.002	0	**0.012**	0.027	0	0	**0.039**	0.001	2	**0.038**
Alternative C	**0.006**	**0**	0.010	0	0	0.002	0	**0.012**	0.027	0	0	**0.039**	0.001	2	**0.038**
LOWER LAGUNA															
Alternative B	**0.004**	**0.001**	0.003	0	0	0.002	0	**0.005**	0	0	0	**0.005**	0	0	**0.003**
Alternative C	**0.002**	**0**	0	0	0	0.002	0	**0.002**	0	0	0	**0.002**	0	0	**0**

5.6 Wildlife

The alternatives proposed in this document have the potential to impact park wildlife. The effects of these impacts are assessed for unlisted park vertebrates and invertebrates, and special status species. Under Alternative A, there would be no planned impacts to park animals, but continued risk of culvert failures poses a threat to some species. The 2 action alternatives – Alternatives B and C – have the potential to impact park animals from heavy equipment use and earthmoving activities.

5.6.1 Alternative A

Under Alternative A, no scheduled culvert upgrade would take place; the existing undersized and failing crossing structures would remain in place.

5.6.1.1 Analysis

Existing management activities, including emergency repair and debris clearing activities, would continue. Road crossings are often an impediment to wildlife migration and movement patterns. The scale of these systems and sites is small. In addition, the speed limits and road traffic are generally limited, reducing the potential for these structures to impede or effect terrestrial wildlife movement or migration. The issues concerning aquatic resources and migration are addressed in the Special Status Species – Fish section.

Under Alternative A, there would be no short-term or long-term effects on wildlife resources within the project areas.

5.6.1.2 Cumulative Effects

Under Alternative A, no action would be taken at any of the 6 sites. Regular ongoing maintenance would result in no short-term effect to wildlife. Alternative A would result in no short-term or long-term cumulative effects to wildlife resources in the project area.

5.6.1.3 Conclusion for No Action Alternative Effects on Wildlife

Under Alternative A, there would be no short-term or long-term effect on wildlife resources.

Table 5.16 Alternative A: Overall Effects on Wildlife

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All Sites	Wildlife	No effect	No effect
	Cumulative	No effect	No effect

Implementation of the Alternative A would not result in impairment of park wildlife resources.

5.6.2 Alternatives B and C

Under action Alternatives B and C, planned construction activities could directly and indirectly impact park animals. Averse impacts include temporary increases in noise, temporary degradation of air quality, soil compaction, removal of vegetation, temporary diversion of streamflow, and increases of stream turbidity. While alternatives B and C differ in approach at 2 sites (Upper Laguna and Lower Laguna), the short and long-term impacts to wildlife of either alternative are considered the same, and are evaluated together. The different restoration approaches evaluated at Upper Laguna and Lower Laguna are described in Section 2.

5.6.2.1 Analysis

Culvert replacement activities at the 6 project sites will entail use of heavy equipment, including excavators, cranes, and dump trucks, for 2 to 3 weeks per site (see Table 2.4). These vehicles will create temporary noise and air quality impacts that may displace some animals from the project sites for the

duration of the culvert replacement work. These impacts would occur during the non-breeding time of year for most animal species. This would create short-term, adverse, and negligible impacts to park wildlife. Impacts to air quality and natural quiet at the project sites as a result of Alternatives B or C are further discussed in sections 5.2 and 5.3 above.

Culvert replacement activities would also impact park animals indirectly through disruption of habitat with vegetation removal and soil compaction. Vegetation removal will degrade wetland habitat at the 6 project sites, and displace wildlife dependent on that habitat. The acreage of wetlands that would be disrupted under Alternative B or C are listed in Table 5.15. Furthermore, although the majority of the work will remain within the pre-existing crossing footprints, vehicles may disrupt an additional 0.5 acres per site. At these staging sites, soils will be compacted and upland plant communities will be degraded. Where additional work, such as boulder cross-vanes and riprap installation, is required, the duration and extent of impacts would be greater.

5.6.2.2 Cumulative Effects

This project would likely occur concurrently with the Coastal Watershed Restoration – Geomorphic Restoration project and potentially the Glenbrook Dam and Quarry Restoration project. Under either Alternatives B or C, project activities would result in localized effects to wildlife. The project areas are separated by at least 0.5 miles, and would not likely result in cumulative effects to individuals. The project timing, after August 1, also avoids the bird nesting season and would minimize potential cumulative impacts on nesting birds. In addition, the Fire Management Plan requires that prescribed burns evaluate impacts associated with each planned ignition boundary. This planning process will have to account for construction activities and potential impacts to wildlife resources.

The project would result in negligible adverse cumulative impacts to wildlife resources.

5.6.2.3 Conclusion for both Alternative B and C: Effects on Wildlife

Under either Alternative B or C, project activities would result in localized effects to wildlife, associated with vegetation removal, staging areas, and noise. These short-term effects are considered minor and adverse. In the long term, the project would result in beneficial effects related to increased stream conveyance and potential passage of aquatic species through these areas.

Table 5.17 Alternative B and C: Overall Effects on Wildlife

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All Sites	Wildlife	Minor adverse	Beneficial
	Cumulative	Negligible adverse	Beneficial

Implementation of either Alternative B or C would not result in impairment of park wildlife resources.

5.7 Special Status Species, Critical Habitat, and Essential Fish Habitat

5.7.1 Alternative A

Under Alternative A, no action, other than regular maintenance activities, would be taken and existing conditions would continue in the short term. The potential for catastrophic failure of these road-crossing structures could result in broader-scale impacts to the water and aquatic resources within the project area.

5.7.1.1 Analysis

Special Status Fish Species
Alternative A would result in no effect in the short term, but potential for catastrophic failure and associated large-scale geomorphic and hydrologic adjustments could result in localized minor to moderate adverse impacts to special status fish and Essential Fish Habitat in the long term.

Special Status Amphibian and Reptile Species
Special status amphibian and reptile special status species potentially living within the project areas include: California red-legged frog (*Rana aurora draytonii*; federally Threatened), northwestern pond turtles *(Clemmys marmorata mormorata*; federal Species of Concern), California freshwater shrimp (*Syncaris pacifica*; federally Endangered), and Myrtle's silverspot butterfly (*Speyeria zerene myrtleae*; federally endangered). Of these, only the California red-legged frog was observed during comprehensive surveys, when it was found only in the Lower Laguna project site. The project sites occur in active stream channels, which are considered non-breeding habitat for the red-legged frog (Fellers and Guscio 2002).

Alternative A would result in no effect in the short term, but potential for catastrophic failure and associated large-scale geomorphic and hydrologic adjustments could result in localized minor adverse impacts to special status amphibian non-breeding critical habitat. Alternative A would not effect special status reptile species in the short or long term.

Special Status Invertebrate Species
Alternative A would not effect special status invertebrate species in the short term or long term.

Special Status Avian Species
Alternative A would not effect special status avian species in the short term. Catastrophic failure of some facilities could result in downstream impacts to neotropical bird nesting habitat. As a result, Alternative A would result in minor adverse effects in the long term.

Special Status Mammal Species
Alternative A would not effect special status mammal species in the short term or long term.

Special Status Plant Species
Alternative A would not effect special status plant species in the short term or long term.

5.7.1.2 Cumulative Effects

Special Status Fish Species
The cumulative effects of potential projects on special status fish species are confined to the watershed. As a result, Alternative A would result in no effect in the short term. The potential for catastrophic failure and associated large-scale geomorphic and hydrologic adjustments could result in minor adverse long-term impacts to special status fish and Essential Fish Habitat within the Drakes Bay area.

Special Status Amphibian and Reptile Species
Under Alternative A, the potential cumulative effect of the projects evaluated would result in no effect to special status amphibian species in the short term. The potential for catastrophic failure and associated large-scale geomorphic and hydrologic adjustments could result in negligible adverse long-term impacts to special status amphibian non-breeding critical habitat within the Drakes Bay area. Alternative A would not result in cumulative effects on special status reptile species in the short or long term.

Special Status Invertebrate Species
Alternative A would not result in cumulative effects on special status invertebrate species in the short or long term.

Special Status Avian Species
Under Alternative A, the potential cumulative effect of projects included in the evaluations would result in no effect to special status avian species in the short term within the Drakes Bay area. Potential catastrophic failure of some facilities could result in downstream impacts to neotropical bird nesting habitat. Alternative A could result in negligible adverse effects in the long term within the Drakes Bay area.

Special Status Mammal Species
Under Alternative A, the potential cumulative effect of the projects evaluated would result in no effect to special status mammal species in the short term within the Drakes Bay area.

Special Status Plant Species
Under Alternative A, the potential cumulative effect of the projects evaluated would result in no effect to special status plant species in the short or long term within the Drakes Bay area.

5.7.1.3 Conclusion for Alternative A Effects on Special Status Species

Alternative A would not result in direct action and would minimize impacts in the short term. However, in the long term, the potential catastrophic failure of some existing structures could result in minor to moderate localized impacts to special status fish, Essential Fish Habitat, and amphibian critical non-breeding habitat within the project area. Table 5.18 summarizes localized effects on specific special status species categories.

Table 5.18 Alternative A: Site Specific Effects on Special Status species

Sites	Special Status Species	Type and intensity of short term effect	Type and intensity of long-term effect
Mt. Vision Crossing	Fish	No effect	Moderate adverse
	Essential Fish Habitat	No effect	Moderate adverse
	Amphibians and Reptiles	No effect	Minor adverse
	CRLF Critical non-breeding habitat	No effect	Minor adverse
	Invertebrates	No effect	No effect
	Birds	No effect	Minor adverse
	Mammals	No effect	No effect
	Plants	No effect	No effect
	Cumulative	No effect	No effect
Estero Road Crossing	Fish	No effect	Moderate adverse
	Essential Fish Habitat	No effect	Moderate adverse
	Amphibians and Reptiles	No effect	Minor adverse
	CRLF Critical non-breeding habitat	No effect	Minor adverse
	Invertebrates	No effect	No effect
	Birds	No effect	Minor adverse
	Mammals	No effect	No effect
	Plants	No effect	No effect
	Cumulative	No effect	No effect
North Home Ranch	Fish	No effect	Negligible adverse
	Essential Fish Habitat	No effect	Negligible adverse
	Amphibians and Reptiles	No effect	Negligible adverse
	CRLF Critical non-breeding habitat	No effect	Negligible adverse
	Invertebrates	No effect	No effect
	Birds	No effect	Negligible adverse
	Mammals	No effect	No effect
	Plants	No effect	No effect
	Cumulative	No effect	No effect
Home Ranch	Fish	No effect	Negligible adverse
	Essential Fish Habitat	No effect	Negligible adverse
	Amphibians and Reptiles	No effect	Negligible adverse
	CRLF Critical non-breeding habitat	No effect	Negligible adverse
	Invertebrates	No effect	No effect
	Birds	No effect	Negligible adverse
	Mammals	No effect	No effect
	Plants	No effect	No effect
	Cumulative	No effect	No effect
Upper Laguna	Fish	No effect	Minor adverse

	Essential Fish Habitat	No effect	Minor adverse
	Amphibians and Reptiles	No effect	Minor adverse
	CRLF Critical non-breeding habitat	No effect	Minor adverse
	Invertebrates	No effect	No effect
	Birds	No effect	Minor adverse
	Mammals	No effect	No effect
	Plants	No effect	No effect
	Cumulative	No effect	No effect
Lower Laguna	Fish	No effect	Negligible adverse
	Essential Fish Habitat	No effect	Negligible adverse
	Amphibians and Reptiles	No effect	Negligible adverse
	CRLF Critical non-breeding habitat	No effect	Negligible adverse
	Invertebrates	No effect	No effect
	Birds	No effect	Negligible adverse
	Mammals	No effect	No effect
	Plants	No effect	No effect
	Cumulative	No effect	No effect

Implementation of Alternative A would not result in impairment of park special status species.

5.7.2 Alternatives B and C

Under action Alternatives B and C, planned construction activities could directly and indirectly impact park animals. Averse impacts include temporary increases in noise, temporary degradation of air quality, soil compaction, removal of vegetation, temporary diversion of streamflows, and stream turbidity increases. While alternatives B and C differ in approach at 2 sites (Upper Laguna and Lower Laguna), the short and long-term impacts to wildlife of either alternative are considered the same and are evaluated together. The different restoration approaches evaluated at Upper Laguna and Lower Laguna are described in Section 2.

5.7.2.1 Analysis

Special Status Fish Species

Construction activities conducted under either Alternative B or Alternative C would require recovery and movement of steelhead trout from the stream bypass reach to suitable habitat adjacent to the project area. The bypass reach would be longer (approximately 100-200 meters) than the proposed project area (50-100 meter section of stream) to avoid impacts to clean water. During the water diversion, NPS fisheries program staff would capture fish using both seine netting and electrofishing techniques. As water within the project area receded, staff would survey to insure that aquatic species (not macroinvertebrates) were moved.

Following construction, the stream reach would be altered and would not likely provide good habitat until winter rains flushed through the system. Fish and other aquatic species could take up residence during this time. Following the first winter, aquatic habitat would likely recover. While it could take longer for the riparian vegetation to restore existing shade and cover conditions, the habitat would be available and would likely be used.

As a result, the restoration activities at these sites would require fish capture and movement to adjacent habitat. It is likely that steelhead would be removed from all sites except North Home Ranch Creek. In addition, construction activities would result in direct impacts to specific reaches of Essential Fish Habitat. In the short term, Alternative B would result in minor adverse impacts to special status fish and Essential Fish Habitat. In the long term, restoration of fish passage and creation of suitable, stable habitat within the project area would be beneficial, at local and watershed scales, for both special status fish and Essential Fish Habitat.

Special Status Amphibian and Reptile Species
Surveys for special status amphibian and reptile species have shown the presence of only the California red-legged frog within or adjacent to project construction sites. A summary of results (Fellers and Guscio 2002) reveals that frogs occur in the watersheds, both upstream and downstream of project areas. The typical habitat at the road crossings is consistent with the description for non-breeding habitat. While critical breeding habitat is present in the vicinity of some of the sites (namely Home Ranch and Lower Laguna), none of the road crossing sites provide critical breeding habitat.

As described in the discussion of fish impacts, aquatic species would be removed from the stream bypass reach, which is larger than the actual construction zone. The site would be surveyed each morning by a qualified biologist to insure that terrestrial aquatic species had not moved into the construction zone. Individuals would be netted and moved to suitable habitat outside of the bypass reach. No special status reptiles were identified as part of the project planning surveys. Northwestern pond turtles do occur within the watershed and could be encountered.

It is possible that the California red-legged frog and the northwestern pond turtle could be encountered during the project. Proposed BMPs (Appendix B) would minimize the potential for direct take of individuals. If individuals were found in the project construction area during the construction period, individuals would be trapped and relocated by a qualified biologist. In addition, construction activities would result in direct impacts to specific reaches of critical non-breeding habitat. No special status invertebrates or reptiles were identified as part of the project planning surveys. However, northwestern pond turtles do occur within the watershed and could be encountered. As a result, the build alternatives (B and C) could result in minor short-term adverse impacts to special status amphibians, reptiles, and critical non-breeding frog habitat. In the long term, the projects would benefit special status amphibians or reptiles.

Special Status Invertebrate Species
Extensive inventories of these watersheds did not document presence of the California freshwater shrimp (Lo Bianco and Fong 2003) in the project watersheds. The Myrtle's silverspot butterfly is an upland species that may occur near the project area. None of the preferred host breeding plants (violet) were documented as part of the site vegetation surveys.

The build alternatives (B and C) would result in the no effect in the short-term and long-term.

Special Status Avian Species
Riparian areas in coastal Marin typically support a variety of breeding neotropical songbirds protected under the Migratory Bird Treaty Act. The proposed construction window for the project begins August 1, after the bird-breeding season. The construction activities at each site would result in short-term noise and disturbance, as well as the removal or alteration of riparian vegetation (potential breeding habitat) during restoration. The area of disturbance, compared to the overall watershed riparian area, is considered negligible.

With construction timed to avoid bird breeding season, and BMPs described in Appendix B, the build alternatives (B and C) would result in short-term, negligible to minor impacts to special status and protected birds, and potential breeding riparian habitat. In the long term, effects are considered negligible. While the recovery of riparian vegetation to its existing levels of cover and maturity would take more than two years, the actual of riparian habitat impacted relative to overall riparian habitat is very small.

Special Status Mammal Species
The project areas are not considered viable habitat for the Point Reyes Mountain Beaver (FSC), which occurs further upstream in colluvial hollow type habitat, not active stream channels. The construction alternatives (B and C) would not effect special status mammal species in the short or long term.

Special Status Plant Species
Surveys of the project areas did not document special status plant species within the construction areas. As a result, the construction alternatives (B and C) would not result in effects to special status plant species in the short or long term.

5.7.2.2 Cumulative Effects

Special Status Fish Species
The project would occur in conjunction with the Coastal Watershed Restoration Geomorphic Restoration project, implementation of the Fire Management Plan, and potentially, the Glenbrook Dam and Quarry Restoration project. Each of these projects would restore natural processes to the area, but would result in localized watershed-scale effects. In the Drakes Bay watershed, large-scale geomorphic and hydrologic adjustments could result cumulatively in minor to moderate, adverse and short-term impacts to special status fish and Essential Fish Habitat. In the long term, restoration of natural hydrologic processes and removal of fish passage impediments would be beneficial to special status fish and Essential Fish Habitat within the Drakes Bay area.

Special Status Amphibian and Reptile Species
In addition to this project, a number of other projects proposed for the park, including the Horseshoe Pond Restoration to Coastal Lagoon, Coastal Watershed Restoration Geomorphic Restoration project, and implementation of the Fire Management Plan, could result in project-specific impacts to California red-legged frogs. While this project includes 6 sites in 4 watersheds draining into Drakes Bay, the project sites provide only non-breeding riparian habitat, and project BMPs will minimize potential for direct take of the California red-legged frog and northwestern pond turtle. Other projects considered in the cumulative effect analysis (specifically Horseshoe Pond and Coastal Watershed Restoration – Geomorphic Restoration Project) would result in localized moderate adverse effects at specific sites. This project would not exacerbate cumulative impacts to the California red-legged frog, northwestern pond turtle and associated critical habitat beyond minor adverse in the short or long-term.

Special Status Invertebrate Species
Cumulative impacts to special status invertebrate species would not increase under either build alternative (B or C). The short-term cumulative impacts are considered and adverse, with no effect in the long term.

Special Status Avian Species
Under Alternatives B and C, the potential cumulative effect of the projects evaluated would result in no effect to special status avian species in the short or long term within the Drakes Bay area.

Special Status Mammal Species
Cumulative impacts to special status mammal species would not increase under either build alternative (B or C). No potential cumulative effects to special status species are identified in the short or long term.

Special Status Plant Species
Cumulative impacts to special status plant species would not increase under either build alternative (B or C). As a result, short-term cumulative impacts to special status plant species are considered negligible, with no long-term potential impacts

5.7.2.3 Conclusion for Alternatives B and C: Effects on Special Status Species

Both build alternatives (B and C) are considered to have the same impacts on special status species and habitat. In general, short-term impacts to habitat are followed by benefits to habitat in the long term. There is no proposed habitat conversion (e.g. pond to marsh). All sites are riparian and will recover to riparian habitat. Specific localized effects are shown in Table 5.19. Project BMPs (Appendix B) would provide further protections to insure that potential for direct take is minimized.

Overall, the project would result in minor short-term adverse impacts to special status species and habitat, and beneficial long-term effects. Implementation of either Alternative B or C would not result in impairment of park special status species.

Table 5.19 Alternative B and C: Site Specific Effects on Special Status species

Sites	Special Status Species	Type and intensity of short term effect	Type and intensity of long-term effect
Mt. Vision	Fish	Minor adverse	Beneficial
Crossing	Essential Fish Habitat	Minor adverse	Beneficial
	Amphibians and Reptiles	Minor adverse	Beneficial
	CRLF Critical non-breeding habitat	Minor adverse	Beneficial
	Invertebrates	No effect	No effect
	Birds	Neg/minor adverse	Negligible adverse
	Mammals	No effect	No effect
	Plants	No effect	No effect
	Cumulative	Minor	Beneficial
Estero Road	Fish	Minor adverse	Beneficial
Crossing	Essential Fish Habitat	Minor adverse	Beneficial
	Amphibians and Reptiles	Minor adverse	Beneficial
	CRLF Critical non-breeding habitat	Minor adverse	Beneficial
	Invertebrates	No effect	No effect
	Birds	Neg/minor adverse	Negligible adverse
	Mammals	No effect	No effect
	Plants	No effect	No effect
	Cumulative	Minor	Beneficial
North Home	Fish	Negligible adverse	Beneficial
Ranch	Essential Fish Habitat	Negligible adverse	Beneficial
	Amphibians and Reptiles	Minor adverse	Beneficial
	CRLF Critical non-breeding habitat	Minor adverse	Beneficial
	Invertebrates	No effect	No effect
	Birds	Neg/minor adverse	Negligible adverse
	Mammals	No effect	No effect
	Plants	No effect	No effect
	Cumulative	Minor	Beneficial
Home Ranch	Fish	Minor adverse	Beneficial
	Essential Fish Habitat	Minor adverse	Beneficial
	Amphibians and Reptiles	Minor adverse	Beneficial
	CRLF Critical non-breeding habitat	Minor adverse	Beneficial
	Invertebrates	No effect	No effect
	Birds	Neg/minor adverse	Negligible adverse
	Mammals	No effect	No effect
	Plants	No effect	No effect
	Cumulative	Minor	Beneficial
Upper Laguna	Fish	Minor adverse	Beneficial
	Essential Fish Habitat	Minor adverse	Beneficial
	Amphibians and Reptiles	Minor adverse	Beneficial
	CRLF Critical non-breeding habitat	Minor adverse	Beneficial
	Invertebrates	No effect	No effect
	Birds	Neg/minor adverse	Negligible adverse
	Mammals	No effect	No effect
	Plants	No effect	No effect
	Cumulative	Minor	Beneficial
Lower Laguna	Fish	Minor adverse	Beneficial
	Essential Fish Habitat	Minor adverse	Beneficial
	Amphibians and Reptiles	Minor adverse	Beneficial
	CRLF Critical non-breeding habitat	Minor adverse	Beneficial

Invertebrates	No effect	No effect
Birds	Neg/minor adverse	Negligible adverse
Mammals	No effect	No effect
Plants	No effect	No effect
Cumulative	Minor	Beneficial

5.8 Impacts to Cultural Resources

Several factors influence the damage to cultural resource resulting from the various alternatives. Some of these factors relate to direct effects of excavation, operational effects of staging of construction equipment, or indirect effects of changes in hydrology, geomorphology, or vegetation. Examples of indirect effects include erosion of artifacts following changes in stream course or erosional patterns. Indirect effects may be delayed and incremental and may be highly correlated with the degree of change inherent to each of the proposed actions.

Impacts resulting from the operation of heavy equipment in close proximity to cultural resources will correlate directly with the nature and extent of the disturbance, local sediment characteristics, and the cultural resources themselves. Impacts associated with construction are generally restricted to displacement, breakage and looting. Except in rare situations, construction-related effects are likely to be most pronounced on cultural resources found on and near the ground surface.

As noted in Affected Environment, cultural resource surveys at Point Reyes are not fully complete, although additional field surveys were completed as part of baseline studies for this project. The areas that are less likely to have been surveyed are those that are difficult to access. Because these areas have not been surveyed, any undocumented resources there are vulnerable.

5.8.1 Alternative A: No Action

This alternative continues the current routine maintenance and management of existing crossing facilities.

5.8.1.1 Analysis

This analysis focuses on continuation of existing routine maintenance and management of existing facilities at the 6 crossings. Routine maintenance would not result in short-term impacts to cultural resources within the project areas.

The project has identified potential for catastrophic failure at Mount Vision and Estero Road crossings. Neither of these sites had cultural resources identified in the initial screening or field surveys. As a result, there is no potential for long-term impacts to cultural resources under Alternative A.

5.8.1.2 Cumulative Impacts

Under Alternative A, there would be no potential impacts to cultural resources as a result of construction activities. While natural processes can lead to loss of historic or archaeological resources, this alternative would not result in cumulative effects to cultural resources in the short or long term.

5.8.1.3 Conclusion

The overall effects of Alternative A or No Action on cultural resources are shown in Table 5.20 below. The current routine maintenance and management of existing crossing facilities would not result in impacts to documented cultural resources.

Most of the potential impacts would result from failure of existing structures, frequent repair and maintenance in the future, and potential geomorphic and hydrologic changes in creeks such as alterations in

stream course and erosion patterns. In general, there would be no short-term impacts to cultural resources under Alternative A, and in the long term, effects are considered negligible.

The proposed actions would not result in impairment to park cultural resources.

Table 5.20 Alternative A: Overall Effects on Cultural Resources

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
All Sites	Cultural	No effect	Negligible adverse
	Cumulative	No effect	No effect

5.8.2 Alternative B: Restore Fish Passage and Minimize Future Maintenance Needs

5.8.2.1 Analysis

This analyses focuses on actions proposed at Estero Road, Mt. Vision Road, Home Ranch, and North Home Ranch. It also includes analysis of construction-related mitigation measures or BMPs that are incorporated into alternatives to reduce risks to cultural resources. Under Alternative B, the proposed action for Upper and Lower Laguna is installation of 30-foot spanning bridge structures on both sites.

While Home Ranch is considered a historic landscape, the crossing structure itself is a metal arch culvert, likely installed in the early 1980s (B. Ketcham, *pers. comm. in* Newland 2004). Therefore, replacement will not impact historic structures (no effect). Currently, the crossing can only convey storm flows that recur every 10 years. Flooding often encroaches on the adjacent residence and barns, which are part of the historic landscape. Under this alternative, flooding would be reduced, allowing twice the conveyance area. In addition, there would be less need for repair and maintenance, which should decrease the risk that construction might inadvertently impact other components of the historic ranch. Overall treatments at Home Ranch would result in no short-term effect to cultural resources, and in the long term, improved conditions would be beneficial.

At North Home Ranch, the proposed actions would not directly or indirectly affect the historic building pad, located approximately 67 feet north of the project area (no effect). It is unlikely that, under the proposed actions, North Home Ranch creek would migrate or meander enough to endanger the building pad. Increasing conveyance of flood flows from a 2-year to a 100-year flow event could potentially increase erosion upstream of the culvert, as the creek readjusts to its new hydrologic and geomorphic equilibrium. The long-term risk that erosion could destroy or harm the iron pipes discovered in the side of the creek bank is considered a minor adverse effect.

Potential impacts to known cultural resources under this alternative would principally occur at the Upper Laguna project area. Cultural resource surveys have revealed the remains of a bridge crossing, specifically 3 wooden timbers set into the creek bottom, and concrete footings buried in blackberry brush on the north bank of a small gully that flows into the creek (Newland 2004). The culvert currently in place probably dates to the Laguna Ranch (NHC 2002). Under Alternative B, the culvert would be replaced with a bridge requiring armoring of excavated slopes, installation of concrete foundations, and placement of multiple grade control structures downstream of the bridge. The grade control would be installed in a manner that preserved the in-channel historic piers. Banks would need to be stabilized or armored with riprap at least 20 feet upstream and downstream of the bridge. Such armoring would avoid the existing concrete footings, and riprap would be placed in a manner to provide additional stability to the structure. These actions would result in minor adverse impacts to the historic remnants, but preservation would be considered beneficial in the long term.

There are no documented cultural resources at the other project areas, nor were any observed during field investigation. It is possible that the degree of riparian overgrowth in some areas has hidden resources, therefore, there is some risk the proposed actions could destroy or harm unknown cultural resources. However, measures will be taken to protect resources discovered during the project. As a result, project actions would not likely effect cultural resources in the short or long /term.

5.8.2.2 Cumulative Impacts

In general, the proposed actions would contribute very little to overall park trends in cultural resource integrity. These proposed action would avoid direct impacts and preserve historic materials, resulting in beneficial long-term effects on cultural resources. Actions that could potentially cause impacts in conjunction with existing operation and management of the crossing infrastructure would be: the Horseshoe Pond Restoration project and Coastal Watershed Enhancement project – Geomorphic Restoration. At all sites, the intent is to avoid impacts to cultural resource areas.

5.8.2.3 Conclusion

The overall effects of the proposed actions on cultural resources are shown in Table 5.21 below. The proposed actions would have no effect at Mt. Vision, Estero, and Lower Laguna sites. Treatment actions at the remaining 3 sites would result in short-term negligible to minor effects but long-term beneficial effects since greater flow conveyance and improved infrastructure would reduce the risk of flooding or catastrophic failure.

The proposed actions would not result in long-term impairment to cultural resources.

Table 5.21 Alternative B: Overall effects on cultural resources

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Mt. Vision Road, Estero Road	Cultural	No effect	No effect
	Cumulative	No effect	No effect
North Home Ranch	Cultural	No effect	Minor adverse
	Cumulative	Negligible adverse	Negligible adverse
Home Ranch	Cultural	Beneficial	Beneficial
	Cumulative	Beneficial	Beneficial
Upper Laguna	Cultural	Minor adverse	Beneficial
	Cumulative	Negligible adverse	Beneficial
Lower Laguna	Cultural	No effect	No effect
	Cumulative	No effect	No effect

5.8.3 Alternative C: Restore Fish Passage and Maximize future management flexibility

Analysis of Alternative C is the same at all sites except Upper Laguna.

5.8.3.1 Analysis

Potential effects of the project on cultural resources are the same at all sites except for Upper Laguna. For the other sites refer to impact analysis under alternative B.

Potential impacts to known cultural resources under this alternative would occur principally at the Upper Laguna project area. Cultural resource surveys have revealed the remains of a bridge crossing, specifically 3 wooden timbers set into the creek bottom, and concrete footings buried in blackberry brush on the north bank of a small gully that flows into the creek (Newland 2004). The culvert currently in place probably dates to the Laguna Ranch (NHC 2002). Under Alternative C, the existing culvert would remain, but multiple grade control structures downstream of the bridge would be installed and the failing headwall would be repaired. The grade control would be installed in a manner that preserved the in-channel historic

piers. Alternative C would not require additional bank stabilization or armoring with riprap (as Alternative B does). These actions would result in minor adverse impacts to the historic remnants, but preservation would be considered beneficial in the long term.

5.8.3.2 Cumulative Impacts

Cumulative impacts are considered the same as those in Alternative B.

5.8.3.3 Conclusion

The overall effects of the proposed actions on cultural resources are the same as those in Alternative B, with the exception of Upper Laguna, where the activities would result in negligible, rather than minor, short-term adverse effects.

The proposed actions would not result in long-term impairment to cultural resources.

Table 5.22 Alternative C: Overall effects on cultural resources

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Mt. Vision Road, Estero Road	Cultural	No effect	No effect
	Cumulative	No effect	No effect
North Home Ranch	Cultural	No effect	Minor adverse
	Cumulative	Negligible adverse	Negligible adverse
Home Ranch	Cultural	Beneficial	Beneficial
	Cumulative	Beneficial	Beneficial
Upper Laguna	Cultural	Negligible adverse	Beneficial
	Cumulative	Negligible adverse	Beneficial
Lower Laguna	Cultural	No effect	No effect
	Cumulative	No effect	No effect

5.9 Impacts to Recreational resources, visitor experience, and aesthetic resources

Each of the alternatives has the potential to affect recreational and aesthetic resources and the visitor experience within PRNS. Construction could impact visitors temporarily by increasing vehicular traffic within PRNS, causing traffic delays within PRNS and near project areas, and even closing roads temporarily. Long-term impacts would principally include: permanent access road closures, rerouting or closure of trails, and permanent changes to the appearance or aesthetic appeal of park resources. The effects on public safety and transportation for residents of NPS housing, NPS-leased ranches, and local community members are addressed separately under Public Safety and Transportation. The potential for construction to negatively affect visitor experience with increased noise is discussed under Soundscapes.

5.9.1 Alternative A: No Action

This alternative continues the current routine maintenance and management of existing crossing facilities.

5.9.1.1 Analysis

This analysis focuses on continuation of existing routine maintenance and management of existing facilities at the 6 crossings. There would continue to be impacts to visitor use and access to trail systems from overtopping of flood flows at road crossings even during relatively minor storm events. Replacement, routine repair and maintenance of existing infrastructure would impact visitor use of trail systems and access resulting in potentially minor to moderate adverse effects in the long term. The potential for existing infrastructure failure, endangering human safety, is discussed under Public Safety and

Transportation. Replacement of failed infrastructure that could take from 2-6 weeks because of the planning, contracting, purchasing, and construction needed. Resultant impacts are moderate, adverse and long-term. Infrastructure failures would close access roads to visitor use and prevent park maintenance of facilities, such as Coast Camp. The structures with the highest probability of catastrophic failure due to poor condition are Estero Road and Mt. Vision Road (NHC 2002).

Even if no failure occurred, the number of routine maintenance and repair days needed under Alternative A would be substantially higher than under Alternatives B and C due to the age, poor condition, and much smaller conveyance of flood flows allowed by the existing infrastructure. These factors would increase the potential for debris jams, sediment accumulation, and other problems requiring maintenance and repair. Most routine repairs would require closure of the crossings for less than one week (adverse, short-term, and minor). During replacement, repairs and maintenance, noise would be generated that could adversely affect visitors within and near the project areas. Impacts to visitor experience from noise are discussed under Soundscapes.

Most of the crossings under consideration are not part of trail systems. Consequently, the continued loss of riparian habitat from bank erosion and downcutting of the creekbed would have no impact on the aesthetic resources of the trails themselves. The North Home Ranch and Home Ranch crossings are not clearly visible to park visitors, either from Estero Trail or from park roads. There has been no loss of riparian habitat at the Lower Laguna project area, the only site where a crossing has been incorporated into the trail system.

5.9.1.2 Cumulative Impacts

There have been very few actions taken in the park which affect the visitor experience. Based on an analysis of the list of projects in Chapter 1, the cumulative impacts of the projects listed with this proposed action could result in minor short-term adverse effects on the park's overall aesthetic resources and visitor experience. Many of the projects listed have long-term, beneficial impacts to aesthetic resources and visitor experience. The projects that could potentially cause short-term impacts, in conjunction with existing operation and management of the crossing infrastructure, would be the Coastal Watershed Enhancement project – Geomorphic Restoration and Glenbrook Dam and Quarry Restoration project. Two of the 3 geomorphic restoration project areas (Limantour Pond, Muddy Hollow Pond) are located near 2 of the road crossings (Upper Laguna, Lower Laguna) and would be accessed by construction equipment using the same road, Limantour Road. Should repair or replacement of Upper or Lower Laguna crossing become necessary, concurrent construction could increase traffic and noise and delay public access to Muddy Hollow Trail and Limantour Beach.

Construction access to both the Glenbrook Dam and one of the 3 geomorphic restoration project areas (Glenbrook Creek) would be Estero Road through Home Ranch to Glenbrook Trail and Muddy Hollow Trail, respectively. Should the Estero Road crossing need to be replaced or repaired during construction at Glenbrook Creek or Glenbrook Dam, traffic and delays could reduce the value of the visitor experience could result in short-term minor adverse effects. Cumulatively, in the long term, results of the restoration activities would be beneficial to park visitors and aesthetic resources.

5.9.1.3 Conclusion

The overall effects of Alternative A on recreation resources, visitor experience, and aesthetic resources are shown in Table 5.23 below. The current maintenance and management regime of existing crossings would have no effect on visitor experience and recreational resources. It would have negligible effects on park aesthetic resources in the short term. The high potential for a catastrophic failure of the Estero and Mt. Vision Roads infrastructure could considerably lengthen the amount of time that associated trail systems remained inaccessible. In addition, accessing the Estero Trail and Bucklin Trails from other starting points is considerably more difficult than for most of the other trail systems. Therefore, Alternative A in these project sites could result in no effect in the short term, but potential moderate adverse impacts to the visitor experience and aesthetic resources in the long term.

Table 5. 23 Alternative A: Overall Effects on Recreational Resources, Visitor Experience, and Aesthetic Resources

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Mount Vision Road	RR/VE	No effect	Moderate adverse
Estero Road	Aesthetic	Negligible adverse	Moderate adverse
	Cumulative	No effect	Minor adverse
Home Ranch	RR/VE	No effect	No effect
North Home Ranch	Aesthetic	Negligible adverse	No effect
	Cumulative	No effect	Minor adverse
Upper Laguna	RR/VE	No effect	Negligible adverse
Lower Laguna	Aesthetic	Negligible adverse	Negligible adverse
	Cumulative	No effect	Minor adverse

5.9.2 Action Alternatives (Alternatives B and C)

Alternatives B and C involve replacement of existing infrastructure, although slightly different approaches would be used for the Upper and Lower Laguna project areas (i.e., bridge versus arch or box culvert). Alternatives B and C propose the same action for Mt. Vision Road, Estero Road, North Home Ranch, and Home Ranch crossings. Therefore, Alternatives B and C have certain elements in common, including BMPs that would be used during construction at the 6 project areas. The action alternatives would affect recreational use and aesthetics in a similar manner and are evaluated in this section.

5.9.2.1 Analysis

This analysis focuses on Alternatives B and C for Estero Road, Mt. Vision Road, Home Ranch, and North Home Ranch. It also includes analysis of construction-related mitigation or BMPs that are incorporated into alternatives to reduce risks to public safety. Proposed actions for Upper and Lower Laguna are discussed under Alternatives B and C.

The primary impacts to recreational resources, visitor experience, and aesthetic resources would occur during construction and future routine repair and maintenance. Replacement of existing infrastructure would temporarily impact visitor use of trail systems and access to trails. In addition, park staff would be temporarily unable to maintain facilities. These temporary closures would result in short-term minor to moderate adverse impacts to park visitors and aesthetic resources, but in the long term, improved facilities would be beneficial.

Construction-related closures would range from 1 to 2 weeks at North Home Ranch, Home Ranch, Upper Laguna and Lower Laguna, and to 2 to 3 weeks at Estero and Mt. Vision Roads. These road crossings would be closed to everyone except construction personnel, park staff, park housing residents, and the residents and staff of Home Ranch. The potential for construction to endanger human safety is discussed under Public Safety and Transportation. Once replacement is completed under Alternatives B and C, infrastructure and flood flow conveyance will be improved, and the number of routine maintenance, repair days and closures due to road flooding are expected to be much less than under Alternative A. These improvements would be beneficial in the long term.

In addition, culvert replacement would decrease the risk of lengthy closures of the Estero and Mt. Vision access roads due to catastrophic failures. Routine repairs would involve closures of crossings for less than one week (adverse, short-term, and minor). During replacement, repairs and maintenance, the noise generated could adversely affect visitors within and near the project site. With the exception of Lower Laguna, the project sites are outside of the trail systems.

During replacement and repair, most of the trail systems or trail destinations (such as Coast Camp) could be accessed by alternate entry points. Estero Trail, which is typically accessed by Estero Road, can be accessed via Muddy Hollow and White Gate Trails. Trails accessed by Mt. Vision Road (such as the

Inverness Ridge Trail), and other trails that spur off of the Inverness Ridge Trail (Bucklin and Drakes View), can be accessed from Limantour Road. Of these alternate routes, only the Estero Trail detour would have more than negligible impacts on visitor experience due to the additional mileage imposed by the detours.

Most of the crossings are not part of trail systems, and consequently, improvements to riparian habitat resulting from the projects would have no impact on the aesthetic resources of the trails themselves. The North Home Ranch and Home Ranch crossings are not clearly visible to park visitors, either from Estero Trail or from park roads. However, improved riparian habitat would improve the park's overall aesthetic resources.

5.9.2.2 Cumulative Impacts

Based on an analysis of the list of projects in Chapter 1, the cumulative impacts of the projects listed with these proposed actions would have an adverse, short-term impact on visitors during construction, but a beneficial, long-term effect on visitor experience and aesthetic resources. Some of the proposed projects would improve the overall visitor experience and aesthetic resources within the park by restoring degraded habitats. The projects that could potentially cause short-term, adverse impacts in conjunction with the proposed actions would be the Coastal Watershed Enhancement Project – Geomorphic Restoration and Glenbrook Dam and Quarry Restoration Project. Construction access for both the Glenbrook Dam and one of the 3 geomorphic restoration project areas (Glenbrook Creek) would be Estero Road through Home Ranch to Glenbrook Trail and Muddy Hollow Trail. Concurrent construction periods would not increase closure time of Estero Road, but could increase the number of traffic delays and construction equipment traffic and noise for visitors.

Two of the 3 geomorphic restoration project areas (Limantour Pond, Muddy Hollow Pond) are located near two of the road crossings (Upper Laguna, Lower Laguna) and would be accessed by construction equipment using the same road, Limantour Road. Should repair or replacement of Upper or Lower Laguna become necessary, concurrent construction periods could increase construction-associated delays, traffic, etc., for visitors on Limantour Road.

5.9.2.3 Conclusion

The overall effects of the build alternatives (B and C) on recreational resources, the visitor experience, and aesthetic resources are listed in Table 5.24. The proposed actions in conjunction with other construction projects proposed nearby would involve adverse, short-term, minor impacts to visitors because of temporary access road and trail closures and increases in traffic, noise, and potential delays associated with construction equipment. However, these adverse impacts would be offset in the long-term by beneficial effects including reductions in the potential for access road and trail closures due to flooding, emergency infrastructure replacement, and frequent repairs and maintenance. In addition, there would be an improvement in the overall aesthetic resources of the park that would increase the value of the visitor experience.

The action alternatives would not result in impairment of park visitor experience or aesthetic resources.

Table 5.24 Build Alternatives (B & C): Overall Effects on Recreational Resources, Visitor Experience, and Aesthetic Resources

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Mount Vision Road	VE	Moderate adverse	Beneficial
Estero Road	Aesthetic	Minor adverse	Beneficial
	Cumulative	Minor adverse	Beneficial
Home Ranch	VE	Minor adverse	Beneficial
North Home Ranch	Aesthetic	Minor adverse	Beneficial
	Cumulative	Minor adverse	Beneficial

Upper Laguna,	VE	Minor adverse	Beneficial
Lower Laguna	Aesthetic	Minor adverse	Beneficial
	Cumulative	Minor adverse	Beneficial

5.10 Impacts to public safety and transportation

Analysis of effects of proposed actions on public safety and transportation focuses on two different aspects of the project. First, it assesses how construction of new infrastructure and replacement of existing infrastructure would affect the safety of visitors, park staff, residents and staff of NPS-leased ranches, and local community members. The action alternatives are compared with Alternative A and the risks to public safety associated with catastrophic failure of existing infrastructure, flooding of access roads, and potential need for construction related to repair or emergency replacement of culverts.

Secondly, the analysis evaluates how the proposed actions would impact general transportation patterns, including increases in construction-related traffic, traffic delays, and closures of access roads for residents of NPS staff housing, residents and staff of NPS-leased ranches, emergency personnel, and local community members. Marin County has established a minimum level-of-service for unincorporated areas such as PRNS that are rated as "D." This level of service rating is defined as unstable, with queues developing rapidly, but no excessive delays (County of Marin 1994). The transportation element of the Marin County General Plan acknowledges that park visitor traffic produces congestion in excess of that expected from local land uses on Sir Francis Drake Boulevard to Point Reyes. The effects of the proposed actions on park visitation and the visitor experience are addressed separately under Recreational Resources, Visitor Experience, and Aesthetic Resources.

5.10.1 Alternative A: No Action

This alternative continues the current routine maintenance and management of existing crossing facilities.

5.10.1.1 Analysis

This analysis focuses on continuation of existing routine maintenance and management of existing facilities at the 6 crossings.

The safety of visitors, park staff, residents and staff of Home Ranch, and other members of the public would be threatened by overtopping flood flows at road crossings during relatively minor storm events; although the likelihood of severe harm from flooding is relatively low. Many of the crossings currently undergo flooding likely to overtop the road during storm events that happen as frequently as every 2 years (North Home Ranch, Lower Laguna) or 10 years (Mt. Vision, Home Ranch; NHC 2002). The Estero Road crossing flexes under the weight of passing cars, and water has been observed running on the outside, as well as the inside, of the culvert barrels for both the Estero Road and Mt. Vision Road facilities. A catastrophic failure could seriously endanger public safety, although the potential for failure remains low to moderate in the long term, depending on the facility.

Should flooding and failure occur, access would be cut off to homes, ranches, and other operations for an extended period of time because NPS would need to plan and implement infrastructure replacement (adverse, short-term, and moderate). The Mt. Vision Road crossing provides access to park staff housing, as well as a FAA transponder site. Upper Laguna also provides access to park staff housing. Estero Road, North Home Ranch, and Home Ranch provide access for residents and staff of Home Ranch, which the NPS leases to tenants. Road users would either be unable to access homes, places of employment, or facilities or would be potentially trapped and unable to leave until auxiliary access or repair plans were developed. Replacement, routine repair or maintenance of existing infrastructure would result in short-term minor impacts to public use of access roads. If there were catastrophic failure, emergency replacement of services could take 2-6 weeks, potentially resulting in minor to moderate adverse impacts to public safety and transportation in the long term. This would close these access roads to public use. Appropriate

measures would be taken during construction to ensure public safety and thereby reduce the risk of adverse impacts to negligible in the short term.

Even if no failure occurred, the number of routine maintenance and repair days needed under Alternative A is expected to be higher than under Alternatives B and C due to the age, poor condition, and much smaller conveyance of flood flows allowed by most of the existing infrastructure. These factors increase the potential for debris jams, sediment accumulation, and other problems that require maintenance and repair. Most routine repairs would require closure of the crossings for less than one day resulting in negligible adverse effects in the long term.

5.10.1.2 Cumulative Impacts

Based on an analysis of the list of projects in Chapter 1, the cumulative impacts of the projects listed with this proposed action would not effect public safety or transportation in the short term. Some of the proposed projects would increase public safety by eliminating failing and degraded infrastructure or reducing the risk of catastrophic fire such as the 1996 Mt. Vision fire.

Catastrophic (unplanned) failure and closures could occur. The long-term cumulative effect under Alternative A is considered minor and adverse.

5.10.1.3 Conclusion

The overall effects of Alternative A on public safety are shown in Table 5.25 below. The current routine maintenance and management of existing crossing facilities would result in negligible adverse, and short-term effects on public safety and transportation.

In the long term, potential for catastrophic failure is highest at Estero and Mt. Vision road crossings, impacts where long-term effects are considered moderate and adverse.

Table 5.25 Alternative A: Overall Effects on Public Safety and Transportation

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Mount Vision Road	Public Safety	Negligible adverse	Moderate adverse
Estero Road	Transportation	Negligible adverse	Moderate adverse
	Cumulative	Negligible adverse	Minor adverse
Home Ranch	Public Safety	Negligible adverse	Minor adverse
North Home Ranch	Transportation	Negligible adverse	Minor adverse
	Cumulative	Negligible adverse	Minor adverse
Upper Laguna,	Public Safety	Negligible adverse	Minor adverse
Lower Laguna	Transportation	Negligible adverse	Minor adverse
	Cumulative	No effect	Minor adverse

5.10.2 Build Alternatives (B and C)

Alternatives B and C involve replacement of existing infrastructure, although slightly different approaches would be used for the Upper and Lower Laguna project areas (i.e., bridge versus arch or box culvert). Alternatives B and C would result in similar potential impacts to public safety and transportation.

5.10.2.1 Analysis

The safety threat to visitors, park staff, residents and staff of Home Ranch, and local community members from overtopping of flood flows at road crossings would be greatly reduced because flood flow conveyance would increase from 2 to 10-year events to 100-year events. In addition, 2 of the crossings that are currently in very poor condition (Estero Road, Mt. Vision Road) would be replaced, thereby substantially reducing the risk of catastrophic failure. Where necessary, guardrails would be installed, increasing public safety. Threats to public safety from construction activities during replacement would be minimized by

limiting public access to the construction site and other safety practices. Construction-related closures would range from 1 to 2 weeks at North Home Ranch and Home Ranch to 2 to 3 weeks at Estero and Mt. Vision Roads.

During infrastructure replacement, access at road crossings would be affected. Mt. Vision Road crossing provides access to park staff housing, as well as a FAA transponder site. Estero Road, North Home Ranch, and Home Ranch provide access for residents and staff of Home Ranch. At Mt. Vision Road, access would be limited to residents and personnel maintaining the FAA transponder site, and they would use the Vision Fire Road. At Estero Road, access would also be limited to residents and staff of Home Ranch. Construction design will include development of alternate crossings within the project area to accommodate limited access during the period of construction. Access would be subject to occasional traffic delays; however, impacts would still be characterized as minor and adverse in the short term. Upper Laguna provides access to park staff housing. Lower Laguna does not provide for vehicle access to the public, but would remain open to hikers (See Impacts to Recreational Resources, Visitor Experience, and Aesthetic Resources). For at least one week during construction, residents of park staff housing near the Upper Laguna crossing would be required to leave cars on the other side of the creek and access their cars by foot.

While construction would affect access, replacement decreases the risk of much lengthier closures of the Estero and Mt. Vision access roads due to catastrophic failures of the culvert infrastructure. In addition, once replacement is completed, the number of access problems due to road flooding and repair is expected to be substantially lower than under Alternative A, because of the improved condition of replacement infrastructure and higher conveyance of flood flows.

Replacement or repair of infrastructure would temporarily increase traffic in the project vicinity. Equipment mobilization and demobilization would be expected to generate a maximum of about 10 trips per site (5 pieces of heavy equipment, round trip). Additional haul truck trips would be required to deliver construction materials to each project area. Equipment deliveries would use US-101, Point Reyes Petaluma Road, State Route 1 and/or Sir Francis Drake to access the Point Reyes area. The presence of large, slow-moving semi-trailers required to haul heavy earthwork equipment would be an annoyance and a potential safety hazard during commute traffic times. To address this issue, the contractor would be required to schedule equipment mobilization and demobilization during off-peak hours (see Environmental Commitments). Once within PRNS, large, slow-moving semi-trailers could continue to temporarily obstruct traffic. To address this potential issue, construction equipment would be staged onsite to keep equipment haulage to a minimum and reduce effects on traffic within the park.

Daily construction-related traffic would consist of construction personnel, who would park vehicles near the project sites. The number of workers expected per site is approximately 10, which could generate 10 roundtrips per day. Relative to the amount of traffic already present on Sir Francis Drake Boulevard and Limantour Road, the traffic increase associated with construction would be minor and adverse during the period of construction. NPS would require the contractor to guarantee open access for emergency vehicles on Limantour Road and Sir Francis Drake Boulevard. In addition, maintaining alternative access routes to Mt. Vision Road and Estero Road would ensure that emergency personnel could reach homes and ranches. No other short-term or long-term impacts to traffic circulation would be expected.

5.10.2.2 Cumulative Impacts

Based on an analysis of the list of projects in Chapter 1, some of the proposed projects would improve public safety by eliminating failing and degraded infrastructure or reducing the risk of catastrophic fire. The projects that could potentially cause short-term transportation impacts in conjunction with the proposed actions would be the Coastal Watershed Enhancement Project – Geomorphic Restoration and Glenbrook Dam and Quarry Restoration Project. Construction access for both the Glenbrook Dam and one of the 3 geomorphic restoration project areas (Glenbrook Creek) would be Estero Road through Home Ranch to Glenbrook Trail and Muddy Hollow Trail, respectively. Should the Estero Road, North Home Ranch, or Home Ranch crossings need to be replaced or repaired during the time that construction occurred at Glenbrook Creek or Glenbrook Dam, there could be a considerable increase in construction traffic for the

residents and staff of Home Ranch. Home Ranch has very little traffic, because it not accessible to the public or park visitors and is only infrequently visited by park staff. There would be a negligible increase in traffic on Sir Francis Drake.

Two of the 3 geomorphic restoration project areas (Limantour Pond, Muddy Hollow Pond) are located near 2 of the road crossings (Upper Laguna, Lower Laguna) and would be accessed by construction equipment using the same road, Limantour Road. Concurrent construction periods could increase construction equipment traffic on Limantour Road resulting in minor adverse effects in the short term.

The cumulative impacts of the projects listed with this proposed action would have a beneficial, long-term effect on public safety and transportation. The construction activities would increase potential for harm to the public, as a result of disobeying closures. With appropriate safety procedures undertaken by the contractor, the project would result in minor adverse effects to public safety in the short term. Cumulative effects of the project would effect transportation. Pre-emptive press releases and posted information regarding road closures would mitigate the effects to transportation and result in minor adverse effects in the short term.

5.10.2.3 Conclusion

The overall effects of the build alternatives (B and C) on public safety and transportation are listed in Table 5.26. In general, the proposed actions would have beneficial, long-term effects on public safety and adverse, short-term effects on transportation. Improvements in public safety would range from minor to moderate, depending on the risk for catastrophic failure of the existing facilities and the potential for flooding. The NPS would ensure that impacts to local community members remain minor by maintaining access to homes, ranches, and facilities during construction.

Build alternatives B or C would not result in impairment to park public safety and transportation.

Table 5.26 Alternatives B and C: Overall Effects on Public Safety and Transportation

Sites	Resources	Type and intensity of short term effect	Type and intensity of long-term effect
Mount Vision Road	Public Safety	Minor adverse	Beneficial
Estero Road	Transportation	Minor adverse	Beneficial
	Cumulative	Minor adverse	Beneficial
Home Ranch	Public Safety	Minor adverse	Beneficial
North Home Ranch	Transportation	Minor adverse	Beneficial
	Cumulative	Minor adverse	Beneficial
Upper Laguna,	Public Safety	Minor adverse	Beneficial
Lower Laguna	Transportation	Minor adverse	Beneficial
	Cumulative	Minor adverse	Beneficial

6.0 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."

6.1 Current and Ongoing Actions

The proposed project is one of several current water resource restoration projects currently in the planning process that are proposed for the enhancement or restoration of PRNS water resources. For the purpose of this analysis, the cumulative effects are evaluated where direct impacts may occur within the Drakes Estero/Drakes Bay watershed. The planning horizon for this cumulative analysis anticipates potential projects that may be implemented within the next 5 years. It should be noted that Best Management Practices (BMP) and environmental commitments developed in this EA for the road-crossing improvements may provide a valuable protocol for subsequent implementation of the other restoration efforts.

Within the project watersheds, impacts associated with farming, dairy, or livestock operation occurred between the 1870s and 1950s. As the history of the Limantour area shows, these areas were divided for development and infrastructure was installed to support a planned community. Each stream crossing remains a part of the Point Reyes National Seashore infrastructure, and is in need of repair or replacement. The design criteria used for this project is consistent with state and federal design guidelines for salmonid fish passage through road crossings. In addition, the project is consistent with NPS management policies (NPS 2000) and park management objectives regarding watershed management.

The stream, wetland and riparian habitats within the project area have developed around these structures and are considered stable. Without maintenance, stability could be threatened. Other projects proposed within the project area include the Coastal Watershed Restoration – Geomorphic Restoration Project and Glenbrook Dam Removal and Quarry Restoration at the mouth of Glenbrook Creek. These are described briefly in Table 4.1.

Within the Drakes Estero watershed, there is ongoing dairy and beef cattle grazing, as well as some additional physical habitat restoration projects, namely restoration Horseshoe Pond as a coastal lagoon.

Other activities within the Drakes Estero and Drakes Bay watershed include replacement of the waste transfer system at the Ken Patrick Visitor Center (2003-2004), and stabilization of the historic Lifeboat Station Marine Railway (2005 or 2006). Neither of these projects would result in impacts that influence the proposed restoration project.

6.2 Past Restoration and Monitoring Activities

Previous monitoring efforts have included post-fire watershed response monitoring within the Muddy Hollow and Glenbrook Creek watersheds (Collins and Ketcham 2001) as well as aquatic surveys for fish habitat (Cappellini and Everly 1997; NPS unpublished 2003), California freshwater shrimp (Fong and Lo Bianco 2003) and the California red-legged frog (Guscio and Fellers 2002). Extensive surveys were conducted as part of the pre-design process for the project and are summarized in the Culvert Replacement Conceptual Design (NHC 2002).

6.3 Cumulative Impacts

The cumulative impacts section analyzes the potentially compounded impacts of implementation at the project sites. It should be noted that cumulative impacts associated with each potential impact topic and alternative are summarized as part of each evaluation section. Cumulative impacts for each impact topic are summarized for each impact topic and alternative as part of Chapter 5.

Because each of these projects (Table 4.1) is identified, individually, as a restoration of natural ecological and physical processes, this section is important to ensure that cumulatively, the ecological resources can adjust to the changes in process brought about by these federal actions. This section summarizes the cumulative impacts by alternative.

6.3.1 Alternative A – No action

Under Alternative A, no construction activities would take place. As a result, potential cumulative effects of regular ongoing maintenance or repair is considered short-term, negligible, and adverse for most of the associated impact topics. In contrast, the potential for catastrophic failure at the sites in poorest condition could occur, resulting in unplanned and uncontrolled physical, biological, and social resource impacts. Long-term cumulative impacts under Alternative A, as a result of potential catastrophic (unplanned) failure of some crossings would include localized moderate (at specific project sites) adverse impacts, and therefore minor cumulative impacts at the park level.

6.3.2 Alternative B – Restore Fish Passage and Minimize Future Maintenance Needs

Actions at 4 of the 6 project sites, Mount Vision, Estero Road, North Home Ranch and Home Ranch are the same for both Alternatives B and C. Alternative B includes installation of bridge structures at both Upper Laguna and Lower Laguna sites. Overall cumulative impacts associated with construction activities are evaluated in conjunction with implementation of the Coastal Watershed Restoration – Geomorphic Restoration Project, Glenbrook Dam removal and Quarry Restoration, and implementation of the Fire Management Plan. With planned implementation in FY2005, these projects would result in negligible to minor cumulative impacts to biological, physical, and social resources in the short term. Because these are specifically oriented to maintenance of existing facilities, and improvement of natural processes, the cumulative impacts of these projects is considered beneficial to park resources in the long term.

6.3.3 Alternative C – Restore Fish Passage and Maximize Long-Term Management Flexibility

Differences in impacts between Alternatives B and C are apparent at the localized level, but cumulatively, the short and long-term effects are the same as those documented for Alternative B - minor and adverse in the short term and beneficial in the long term.

6.4 Short-term uses versus long-term productivity

Each of the action alternatives would fulfill the project purpose and need. The National Park Service has determined that the environmentally preferred alternative is Alternative B. The National Park Service has selected Alternative C as the park's preferred alternative. It is preferred because it meets all of the overall project objectives, but does not to preclude the long-term management options at the two Laguna Creek sites associated with the General Management Plan and Wilderness planning processes.

The preferred alternative would restore or enhance natural hydrologic and floodplain process, consistent with the documented project purpose and need. Many of the existing facilities are in need of replacement or repair. Treatments would address the hydrologic and geomorphic conditions that impede natural ecological processes. These unnatural conditions create sharp gradients that are inconsistent with the native habitats that existed prior to the anthropogenic landscape changes of the last 150 years. The project activities would result in restoration to more sustainable habitats. The long-term sustainability and ecological productivity of these restored areas is consistent with long-term National Park Service management goals and policies.

7.0 Consultation and Coordination

7.1 Consultation Requirements

This project will require consultation through the following agencies:

Federal consistency review - California Coastal Commission
Some of the sites associated with this project are within the coastal zone, and subject to federal consistency review by the CCC. Federal consistency review 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.

Clean Water Act Section 401 certification - San Francisco 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. Onsite visits will be conducted with staff from the Board. In conjunction with the public release of this document, the NPS would apply for CWA 401 certification from the San Francisco Regional Water Quality Control Board.

Clean Water Act Section 404 consultation and permit - US 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. 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.

Endangered Species Act – Section 7 consultation
US Fish and Wildlife Service & National Marine Fisheries Service 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 threatened or endangered species likely to be affected by the proposed action. In conjunction with the public release of this document, NPS has initiated consultation with the U.S. Fish and Wildlife Service and NOAA Fisheries regarding this project.

NHPA - Section 106 documentation and compliance - California Historic Preservation Office
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.

NHPA - Section 106 review - Federated Indians of Graton Rancheria.
The initial cultural resources study was undertaken in consultation with the Federated Indians of Graton Rancheria (FIGR). A FIGR representative was involved with initial site surveys. No archaeological

resources were documented at the 6 sites identified as part of this environmental analysis. Consistent with other projects, the NPS will coordinate with the FIGR if new information or resources are uncovered during implementation of this project.

7.2 Persons Consulted

Marc D'Avignon, US Army Corps of Engineers
Dr. Bill Jackson – NPS Water Resources Division
Dr. Gary Fellers – USGS-BRD
Frank Ross – Federated Indians of Graton Rancheria

7.3 Report Preparers

Brannon Ketcham, Park Hydrologist, Point Reyes National Seashore
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Mark Rudo, Archaeologist, Pacific West Region

7.4 Public and Agency Scoping and Summary of Issues Raised

Project scoping was conducted between June 10, 2002 and July 10, 2002. The public scoping document was mailed to the park's public outreach mailing list, which includes more than 200 recipients. A total of 2 letters regarding this project were received. One letter expressed support for the project and proposed actions. The other questioned whether the project would be able to achieve its purpose without remedying problems at other crossings (downstream) within the subwatersheds, specifically the East Schooner Creek and Laguna subwatersheds. Those issues with potential for effect are addressed in this EA.

NPS has conducted internal scoping as well. Through internal scoping, NPS examines potential environmental issues, raised by NPS staff, that are relevant to the proposal. Those issues with potential for effect are addressed as part of this EA.

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Appendix A:

Special Status Species Table

List of Federally threatened and endangered plant and animal species with potential to occur in the Coastal Watershed Restoration Project Area and vicinity. Potential to occur based on known species ranges, general habitat requirements, and historical sightings (from Coastal Watershed Restoration Project Biological Assessment), 2004.

Scientific name	Common name	Status	Habitat	Comments	Known to Occur	Subject to Impacts
Mammals						
No terrestrial or freshwater mammals. Marine mammals (Guadalupe fur seal, Steller sea lion, sei whale, blue whale, fin whale, right whale, and sperm whale) are not know or expected to occur in the project areas[1, 2]						
Birds						
Pelecanus occidentalis californicus	California brown pelican	FE	Open water and roosts on mud flats and offshore rocks; breed in Channel Islands.	Brown Pelicans do not breed at PRNS, but commonly occur in the estuaries and along the coastline in the summer, fall, and winter.	Abundant	Yes
Brachyramphus marmoratus	Marbled murrelet	FT	Mature, coastal coniferous forests for nesting; nearby coastal water for foraging; nests in conifer stands greater than 150 years old and may be found up to 35 miles inland; winters on subtidal and pelagic waters often well offshore	No suitable habitat or known occurrences in the vicinity of the proposed projects	Uncommon	No[4]
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). Historically nested at Drakes Beach	Yes	Yes
Diomedea albatrus	Short-tailed albatross	FE	Adults spend the summer non-breeding season at sea in the Aleutian Islands, Bering Sea, and Gulf of Alaska.	There are no known breeding colonies at PRNS and only rare sightings of individuals at sea in the vicinity of Cordell Bank near Point Reyes	Rare	No[4]
Haliaeetus leucocephalus	Bald eagle	FT	In western North America, nests and roosts in coniferous forests within a mile of a significant body of water (e.g. lake, reservoir, river, or the ocean)	Reintroduced into central coast, but PRNS currently known only as winter habitat.	No	No[4]
Sterna antillarum (=albifrons) browni	California least tern	FE	Nests on sandy, upper ocean beaches, and occasionally uses mudflats; forages on adjacent surf line, estuaries, or the open ocean	Suitable habitat exists within the action areas, but species occurrences are rare.	Rare	No[4]
Strix occidentalis caurina	Northern spotted owl	FT	Dense old-growth or mature forests dominated by conifers with topped trees or oaks available for nesting crevices	A permanent resident throughout its range; found in the north Coast, Klamath, and western Cascade Range from Del Norte County to Marin County	No	No[4]
Reptiles						

No terrestrial or freshwater reptiles. Marine turtles (loggerhead turtle, green turtle, leatherback turtle, and olive (=Pacific) Ridley sea turtle) are not known or expected to occur in the project areas[2]						
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	Yes
Fish						
Eucyclogobius newberryi	Tidewater goby	FE	Found in shallow lagoons and lower stream reaches, they need fairly still but not stagnant water & high oxygen levels.	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, but reintroduction proposed	No[5]
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). Not found in any action area streams in 2002 surveys	No	No[6]
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.	Yes	Yes
Oncorhynchus mykiss	Central Valley steelhead	FT	Needs beds of loose, silt-free coarse gravel for spawning; needs cover, cool water and sufficient dissolved oxygen.	Potential for presence during migration, but highly unlikely. Will effectively be analyzed within determination for central California coastal steelhead.	No	No[6]
Oncorhynchus tshawytscha	CA coastal chinook	FT	Cold, clear water with clean gravel of appropriate size for spawning; most spawning occurs in headwater streams; migrate to the ocean to feed and grow until sexually mature	Not known to occur historically or presently within action area watersheds	No	No[6]
Invertebrates						
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.	Yes	Yes
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	No[3]

Plants						
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	No[7]
Chorizanthe robusta	Robust spineflower	FE	Coastal sand, scrub.	Known to occur within PRNS	No	No[7]
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	No[7]
Layia carnosa	Beach layia	FE	Coastal dunes.	Present in PRNS (PRNS 2001).	No	No[7]
Lupinus tidestromii	Tidestrom's lupine	FE	Coastal dunes.	Present in PRNS (PRNS 2001).	No	No[7]
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	No[7]

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.

List of Federal Species of Concern with potential to occur in the Coastal Watershed Restoration Project Area and vicinity. Potential to occur based on known species ranges, general habitat requirements, and historical sightings (from Coastal Watershed Restoration Project Biological Assessment, 2004).

Scientific name	Common name	Habitat	Comments	Known to Occur	Subject to Impacts
Mammals					
Aplodontia rufa phaea	Point Reyes Mountain Beaver	This subspecies of the common mountain beaver is only known to occur in Marin County, and its range is almost entirely within Point Reyes National Seashore. North facing slopes of hills & gullies in areas overgrown with sword ferns and thimbleberries.	The Point Reyes mountain beaver inhabits moderately dense coastal scrub habitat in colluvial hollows, and may use scrub habitat in the vicinity of all three project sites.	Yes	Yes
Corynorhinus (=Plecotus) townsendii townsendii	Pacific western big-eared bat	Roosts in caves, tunnels, mines, and dark attics of abandoned buildings. Very sensitive to disturbances and may abandon a roost after one onsite visit	No documented occurrences	No	No

Eumops perotis californicus	Greater western mastiff-bat		No documented occurrences	No	No
Myotis evotis	Long-eared myotis bat	Occurs primarily in high elevation coniferous forests, but also found in mixed hardwood/conifer, high desert, and humid coastal conifer habitats	No documented occurrences	No	No
Myotis thysanodes	Fringed myotis bat	Found in a wide variety of habitats from low desert scrub to high elevation coniferous forests. Day and night roosts in caves, mines, trees, buildings, and rock crevices	No documented occurrences	No	No
Myotis volans	Long-legged myotis bat	Most common in woodlands and forests above 4,000 feet, but occurs from sea level to 11,000 feet	No documented occurrences	No	No
Myotis yumanensis	Yuma myotis bat	Found in a wide variety of habitats from sea level to 11,000 ft., but uncommon above 8,000 ft. Optimal habitat is open forests and woodlands near water bodies	No documented occurrences	No	No
Zapus trinotatus orarius	Point Reyes jumping mouse	Riparian and grassland.	Occurrence near Abbotts Lagoon and Limantour Beach (G. Fellers, 2002)	Potentially	Yes
Birds					
Agelaius tricolor	Tricolored blackbird	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	No
Arenaria melanocephala	Black turnstone	Forages along the shore by probing for invertebrates using its bill. It roosts in upland areas during high tide. Nesting in the Alaskan tundra, its migration peaks in August and April.	May be found in unvegetated tidal areas of PRNS from autumn through spring	Yes	Yes
Athene cunicularia	Burrowing owl	Nests in burrows in open fields; winters in same area.	Rare but regular migrant to PRNS (Stallcup 2000).	Likely (see comment)	No
Buteo regalis	Ferruginous hawk	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)	No
Calidris canutus -	Red knot	Breeds in the arctic in summer. Migrates to coastal southern/central California in autumn-spring. Favors sparsely vegetated mud and sand shorelines	Seen in small numbers at PRNS, but not at Limantour Beach site but seen in Drakes Estero.	Unlikely	No
Chaetura vauxi	Vaux's swift	Forests, especially with burned or cutover areas	Regularly occurring migrant, not known to	Likely (see	No

		providing snags; nests on inside walls of hollow trees and occasionally in chimneys.	breed at PRNS (Stallcup 2000).	comment)	
Cypseloides niger	Black swift	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	No
Elanus leucurus	White-tailed kite	Savanna, riparian woodland, marsh, partially cleared or cultivated fields, grassy foothills.	Regularly occurring resident at PRNS (Stallcup 2000).	Likely (see comment)	No
Empidonax traillii brewsteri	Little willow flycatcher	Riparian habitat	Rare but regular migrant through PRNS (Stallcup 2000).	No	Yes
Falco peregrinus anatum	American peregrine falcon	High cliffs, ledges for nesting	May breed at PRNS; observed within Project Area in the summer and fall.	Yes	No
Geothlypis trichas sinuosa	Saltmarsh common yellowthroat	Freshwater, saltwater marshes with thick, continuous cover	Breeds in coastal marshes throughout PRNS (NDDB 2000). Observed at top of west arm of Horseshoe Pond and breeds in ponds near Limantour Beach.	Yes	Yes
Haematopus bachmani	Black oystercatcher	A permanent resident on rocky shores of marine habitats. Uncommon to locally fairly common in northern and central California and on Channel Islands (Cogswell 1977).	Breeds at Point Reyes Headland and Double Point but not in Drakes or Limantour Esteros.	No	No
Histrionicus histrionicus	Harlequin duck		Occurs during winter near Point Reyes Headland in nearshore with rocky substrate	No	No
Lanius ludovicianus	Loggerhead shrike	Open fields with scattered trees, open woodland, scrub.	Regularly occurring in winter mostly; breeds at PRNS (Stallcup 2000).	Likely (see comment)	No
Laterallus jamaicensis coturniculus	California black rail	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).	Unlikely	No
Limosa fedoa	Marbled godwit	A common to abundant migrant and winter visitant from mid-August to early May in estuarine habitats. Most common on estuarine mudflats, but also occurs on sandy beaches, open shores, saline emergent wetlands, and adjacent wet upland fields	Not known to breed in PRNS but migrates through (Stallcup 2000). Regularly occurs in the esteros.	Likely	No
Melanerpes lewis	Lewis' woodpecker	An uncommon, local winter resident occurring in open oak savannahs, broken deciduous, and coniferous habitats.	No documented occurrences	No	No
Numenius americanus	Long-billed curlew	Nests in prairies and grassy meadows, usually near meadows; forages on beaches and mudflats.	Regularly occurring resident (Stallcup 2000).	Yes	No
Numenius phaeopus	Whimbrel	Forages on rocky intertidal and sandy beach marine habitats, on the intertidal mudflats of estuarine habitats, and on wet meadow and	Not known to breed in PRNS but migrates through (Stallcup 2000). Regularly occurs in	Likely	No

		pasture habitats adjacent to the immediate coast. Occasionally forages on lawns or golf courses. Inland, prefers flooded fields, wet meadows, croplands and the margins of riverine and lacustrine habitats	the esteros.		
Oceanodroma homochroa	Ashy storm-petrel	Spends most of its time at sea, coming to land only to reproduce.	Breeds at Point Reyes Headland and Double Point but not in Drakes or Limantour esteros.	No	No
Riparia riparia	Bank swallow	Open country, savanna, especially near running water.	Rare but regular migrant (Stallcup 2000).	Yes	No
Rynchops niger	Black skimmer	Requires shallow, calm water for foraging, and sand bars, beaches, or dikes for roosting and nesting.	Accidental sightings in PRNS	No	No
Selasphorus rufus	Rufous hummingbird	Found in a wide variety of habitats that provide nectar-producing flowers; uses valley foothill hardwood, valley foothill hardwood-conifer, riparian, and various chaparral habitats in both northward and southward migration; montane riparian, aspen, and high mountain meadows (to tree-line and above) used in southward migration. More common in the southern deserts in southward than in northward migration.	Regular breeding resident (Stallcup 2000).	Likely	No
Selasphorus sasin	Allen's hummingbird	Chaparral, thickets, brushy slopes, open coniferous forest.	Regularly occurring breeder; summer mostly (Stallcup 2000).	Yes	No
Sterna elegans	Elegant tern	Preferred habitats are inshore coastal waters, bays, estuaries, and harbors; rarely occurs far offshore, and never inland.	Not known to breed in PRNS but forages in summer and winter (Stallcup 2000). Regularly occurs in the esteros.	Yes	Yes
Reptiles					
Clemmys marmorata mormorata	Northwestern pond turtle	Near-permanent water with basking sites	First documented in Horseshoe Pond in October 2001.	Yes	No
Phrynosoma coronatum frontale	California horned lizard	occur in several habitat types, ranging from areas with an exposed gravelly-sandy substrate containing scattered shrubs, to clearings in riparian woodlands, to dry uniform chamise chaparral to annual grassland with scattered perennial seepweed or saltbush	No documented occurrences	No	No
Amphibians					

Rana aurora aurora	Northern red-legged frog	Found in ponds and intermittent and permanent streams with slow or still water. Intermittent streams must retain surface water in pools year-round in order for frogs to survive	No documented occurrences	No	No
Rana boylii	Foothill yellow-legged frog	Found in or near rocky streams in a variety of habitats, including valley-foothill hardwood, valley-foothill hardwood-conifer, valley-foothill riparian, ponderosa pine, mixed conifer, coastal scrub, mixed chaparral, and wet meadow types.	No documented occurrences	No	No
Fish					
Lampetra tridentata	Pacific lamprey	Anadromous. Spawn in low gradient sections of water, with gravel and sandy bottoms. Juvenile spend 3-4 years in mud before returning to the ocean.	No documented occurrences	No	No
Invertebrates					
Cicindela hirticollis gravida	Sandy beach tiger beetle	Coastal sand dunes.	Distribution and abundance unknown (D. Adams, 2001)	Unknown	No
Coelus globosus	Globose dune beetle	California coastal dunes; subterranean dweller.	Distribution and abundance unknown (D. Adams, 2001)	Unknown	No
Icaricia icarioides	Point Reyes blue butterfly	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	No
Helminthoglypta arrosa williamsi	William's bronze shoulderband snail	Poorly understood. No information found.	No documented occurrences	No	No
Helminthoglypta nickliniana awania	Nicklin's Peninsula Coast Range snail	Poorly understood. No information found.	No documented occurrences	No	No
*Hydrochara ricksecker*i	Ricksecker's water scavenger beetle	Known only from pond habitats scattered around the San Francisco Bay area, including Marin, Sonoma, Alameda, and Contra Costa counties.	No documented occurrences	No	No
Incisalia mossii marinensis	Marin elfin butterfly	Poorly understood. No information found.	No documented occurrences	No	No
Lichnanthe ursina	Bumblebee scarab beetle	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	No
Plants					
Abronia umbellata ssp. Brevifolia	Pink sand-verbena	Disturbed sandy areas; coastal dunes and scrub; <100 m.	Present in PRNS (PRNS 2001). Most occurrences have few plants (CNPS 2001).	Yes	No

Agrostis blasdalei var. Blasdalei	Blasdale's bent grass	Coastal dunes, prairie, bluffs, and scrub.	Known from fewer than 15 occurrences (CNPS 2001). Present in PRNS (PRNS 2001).	No	No
Arabis blepharophylla	Coast rock-cress	Found on rocky coastal bluffs and ridges with thin soils. It typically lives in grasslands and steep moist places on north-facing slopes.	No documented occurrences	No	No
Arctostaphylos virgata	Marin (=Bolinas) manzanita	Associated with forest openings and scattered elsewhere, for example on the Bolinas Ridge. Blooms starting in late January.	No documented occurrences	No	No
Astragalus nuttallii var. virgatus	Nuttall's milk-vetch	No information found	No documented occurrences	No	No
Astragalus pycnostachyus var. pycnostachyus	Marsh milkvetch (=brine milk-vetch)	Coastal dunes, coastal salt marshes, seeps.	No documented occurrences	No	No
Atriplex californica -	California saltbush	Coastal strand and near edge of coastal salt marsh, coastal sage scrub, sea bluffs	No documented occurrences	No	No
Blennosperma nanum var. Robustum	Point Reyes blennosperma	Coastal prairie and scrub.	Known from fewer than 15 occurrences; some PRNS populations intermediate to B. Var. Nanum (CNPS 2001).	No	No
Calamagrostis crassiglumis	Thurber's reed grass	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	No
Calystegia purpurata ssp saxicola	Coastal bluff morning-glory	No information found	No documented occurrences	No	No
Campanula californica	Swamp harebell	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	No
Castilleja affinis spp. affinis	Coast Indian paintbrush	Chaparral and coastal scrub from the North Coast and outer North Coast Ranges to the foothills of the Cascade Ranges	No documented occurrences	No	No
Castilleja ambigua ssp. ambigua	salt marsh owl's clover (=johnny-nip)	Coastal salt marshes	Ranges from California North Coast in the Humboldt Bay area to the northern Central Coast in the Point Reyes area	No	No
Castilleja ambigua ssp. Humboldtiensis	Humboldt Bay owl's-clover	Coastal salt marsh.	Known only from Humboldt and Marin counties (NDDB 2001).	No	No
Castilleja exserrta ssp. latifolia	purple owl's-clover (=wideleaf Indian paintbrush)	Blooms from March to May on grassy slopes and openings in chaparral and coastal sage scrub below 3000 feet.	No documented occurrences	No	No
Ceanothus gloriosus	Mount Vision	Closed-cone coniferous forest; coastal prairie;	Known from fewer than 15 occurrences in the	No	No

var. Porrectus	ceanothus	coastal scrub; valley and foothill grassland.	Mount Vision area in PRNS (CNPS 2001; NDDB 2001).		
Chorizanthe cuspidata var. Cuspidata	San Francisco Bay spineflower	Sandy areas in coastal dunes, coastal prairie, and coastal scrub.	Not known from PRNS (PRNS 2001).	Chorizanthe cuspidata does occur	No
Chorizanthe cuspidata var. Villosa,	Wooly headed spineflower	Sandy areas in coastal dunes, coastal prairie, and coastal scrub.	Not known from PRNS (PRNS 2001).	Chorizanthe cuspidata does occur	No
Cirsium andrewsii	Franciscan thistle	Frequents wet or marshy ground along streams and seeps, sometimes on serpentine soils.	No documented occurrences	No	No
Clarkia davyi	Davy's clarkia		No documented occurrences	No	No
Collinsia corymbosa	Round-headed Chinese houses	Coastal Dunes	No documented occurrences	No	No
Cordylanthus maritimus ssp. Palustris	Point Reyes bird's-beak	Coastal salt marsh.	Present in several areas in Drakes Estero and Limantour Marsh (NDDB 2001, PRNS 2001).	No	No
Dirca occidentalis	Western leatherwood	Riparian woodlands, forest and chaparral.	No documented occurrences	No	No
Erigeron supplex	Supple daisy	Coastal bluff scrub; coastal prairie.	Possibly extirpated from the area (USFWS April 2001).	No	No
Fritilaria lanceolata var tristulis	Marin checker lily		No documented occurrences	No	No
Fritillaria liliacea	Fragrant fritillary (= prairie bells)	Often on serpentine soils in coastal scrub, coastal prairie, and valley and foothill grassland.	Present in PRNS (PRNS 2001, NDDB 2001).	No	No
Gilia capitata ssp. *chamissonis*	San Francisco (=bluehead, Chamisso's, dune) gilia	Sandy soil and dunes near the coast. Occurs in open areas in coastal scrub communities.	No documented occurrences	No	No
Gilia capitata ssp. *tomentosa*	Woolly-headed gilia	Coastal bluff scrub	Known from only three occurrences near Tomales and Salt Pt.	No	No
Gilia millefoliata	Yarrow-leaf (=manyleaf, dark-eyed) gilia	Coastal dunes	No documented occurrences	No	No
Grindelia hirsutula var. Maritima	San Francisco gumplant	Sandy, serpentine soils in coastal bluff scrub, coastal scrub, and valley and foothill grassland.	Present in PRNS (PRNS 2001).	No	No
Hesperevax sparsiflora var. *brevifolia*	Short-leaved evax	Coastal bluff scrub and Coastal dunes	No documented occurrences	No	No

Horkelia cuneata ssp. Sericea	Kellogg's horkelia	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	No
Horkelia marinensis	Point Reyes horkelia	Coastal dunes, prairie, and scrub.	Present in PRNS (PRNS 2001). Known from fewer than 20 occurrences (CNPS 2001).	No	No
Lilium maritimum	Coast lily	Broadleafed upland forest; closed-cone coniferous forest; coastal prairie; coastal scrub; and North coast coniferous forest.	Present in PRNS (PRNS 2001).	No	No
Limnanthes douglasii ssp. Sulphurea	Point Reyes meadowfoam	Coastal prairie; mesic areas in meadows; freshwater marsh; and vernal pools.	Known from approximately 10 occurrences (CNPS 2001). Present in PRNS (PRNS 2001).	No	No
Linanthus grandiflorus	Large-flowered (=flower) linanthus	Uncommon in open grassy flats generally in sandy soil from the North and Central Coast to the San Francisco Bay Area; < 1200 m.	No documented occurrences	No	No
Microseris paludosa	marsh microseris (=marsh silverpuffs)	Closed-cone coniferous forest, Cismontane woodland, Coastal scrub, and Valley and foothill grasslands	No documented occurrences	No	No
Monardella undulata	Curly-leaved (=curlyleaf) monardella	Coastal scrub and dune habitat. Also known from chaparral.	No documented occurrences	No	No
Perideridia gairdneri ssp. Gairdneri	Gairdner's yampah	Mesic areas in broadleafed upland forest, chaparral, valley and foothill grassland, and vernal pools.	Present in PRNS (PRNS 2001).	No	No
Phacelia insularis var. Continentis	Northcoast phacelia	Coastal bluff scrub; coastal dunes.	Known from approximately seven occurrences (CNPS 2001). Present in PRNS (PRNS 2001).	No	No
Piperia elegans spp. decurtata	Pt. Reyes rein orchid	grasses, scrub, full sun on coastal bluffs	Grows only on the Chimney Rock peninsula and near the Pt. Reyes Lighthouse	No	No
Polygonum marinense	Marin knotweed	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	No
Rhynchospora californica	California beaked-rush	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	No
Sagittaria sanfordii	Valley sagittaria (=Sanford's arrowhead)	Assorted shallow freshwater marshes and swamps.	Not known from PRNS (PRNS 2001).	No	No
Sidalcea calycosa	Point Reyes		No documented occurrences	No	No

ssp *rhizomata*	checkerbloom				
Sidalcea hickmanii ssp. *Viridis*	Marin checkerbloom	Serpentine areas in chaparral.	Not known from PRNS (PRNS 2001).	No	No
Spartina foliosa	Pacific cordgrass (=California cordgrass)	Coastal salt marsh	Found in Drakes Estero	Yes	Yes
Stellaria littoralis	Seashore (=coast, =beach) starwort	Coastal dunes, bluffs and scrub.	No documented occurrences	No	No
Triphysaria floribunda	San Francisco owl's-clover	Serpentine areas in coastal prairie and valley and foothill grassland.	Present in PRNS (PRNS 2001).	No	No

Appendix B:

Best Management Practices

Point Reyes National Seashore is committed to protecting human safety and to providing stewardship of the nation's natural and cultural resources. The Seashore has committed to a set Best Management Practices (BMPs); these are measures and techniques to be implemented by Seashore staff and their contractors in order to mitigate or eliminate adverse effects that may result from construction activities or continuing maintenance. These BMPs will be incorporated into construction plans, specifications, and contracts, to ensure that personnel engaging in construction activities or continuing maintenance on behalf of the Seashore will proceed in the most environmentally sensitive and safety conscience manner possible.

In order to address many habitat and water quality concerns, the construction window for the project is August 1 through October 31 of the construction year.

The following sections describe the Seashore's commitments with regard to protecting cultural resources, recreational opportunities, natural quiet and soundscapes, air quality, public safety, water quality, wildlife, and vegetation. The protocols below also outline the Seashore's Spill Prevention and Response Plan intended to minimize risks from hazardous materials.

Many components of these measures would also be covered during a site meeting prior to construction. At each site, sensitive areas and issues would be discussed to insure that operators are familiar with the resources and understand their role to insure that potential impacts are avoided.

Measures to Protect Cultural Resources

The NPS will coordinate with the Federated Indians of Graton Rancheria (FIGR) to insure that either an NPS or FIGR representative is on site during the construction activities. While the project has been designed exclude work in 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).

Measures to Protect Recreational Opportunities

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 alternate parking, restroom facilities, and trail access points will be posted on the park website, distributed at the Bear Valley Visitor Center, and posted at each construction site. Information on alternate recreational opportunities, and in particular alternative birding sites, will be publicized on the park website, in the park newsletter, and in signage at the construction sites where closures are necessary.

Measures to Protect Natural Quiet and Soundscapes

Seashore staff and NPS contractors will implement the following measures to reduce construction noise and lessen the impacts of noise that cannot be avoided.

Construction equipment will be required to have sound-control devices at least as effective as those originally provided by the manufacturer, and no equipment will be operated with an unmuffled exhaust. In general, construction will take place between 7:00 a.m. and 7:00 p.m., Monday through Saturday.

In addition, NPS will post signs at each restoration site and on the park website providing the name and contact information for an NPS staff member the public can contact with noise concerns. This person will be responsible for recording and monitoring complaints related to construction noise, and for ensuring that logged complaints are mitigated to the maximum extent possible. Construction times and contact information for noise concerns will also be publicized in the park newsletter.

Measures to Protect Air Quality

The NPS and its contractors will implement the following measures to control the generation of fugitive dust during site preparation and construction activities. These measures are contained in the Bay Area Air Quality Management District's (BAAQMD's) Feasible Control Measures for PM10 Emissions[1] from Soil Removal Activities (BAAQMD 1996).

- Limit the area subject to excavation, grading and other construction activity at any one time.
- Water unpaved access roads, parking areas, and staging areas as necessary, or stabilize them with nontoxic soil stabilizers approved for use adjacent to surface waters.
- Apply (nontoxic) soil stabilizers to inactive earthwork areas (previously graded areas inactive for 10 days or more).
- Enclose, cover, water, or apply nontoxic soil stabilizers to exposed stockpiles as necessary.
- Maintain properly tuned equipment and limit idling time to 5 minutes.
- Cover trucks hauling soil, sand, or other loose materials, or require them to maintain at least 2 feet of freeboard.
- Replant vegetation or topsoil disturbed areas as quickly as possible.
- Limit traffic speeds on unpaved roads to 10 mph.

Measures to Protect Public Safety

NPS will retain qualified geologic and geotechnical personnel to perform engineering geologic and geotechnical studies at each site during the design and construction phases of the proposed action, in order to ensure appropriate design for existing substrate conditions. Design recommendations will be presented to NPS in the form of written soils engineering and engineering geologic reports. The geologic and geotechnical personnel will also be responsible for monitoring earthwork and construction to ensure compliance with applicable codes and standards and with the recommendations of the soils and engineering geologic reports.

The NPS and its contractors will require the construction contractor to prepare and implement a traffic safety plan. The traffic safety plan will address appropriate vehicle size and speed, travel routes, closure plans, detour plans (if any), flagperson requirements (if any), locations of turnouts to be constructed (if any), coordination with law enforcement and fire control agencies, measures ensuring emergency access, and additional need for traffic or speed-limit signs. Delivery and haulage access, including contractor mobilization and demobilization, will be scheduled to minimize impacts on traffic on area roadways, including US-101. Construction worker parking and access will be managed to avoid impeding access for park visitors and emergency vehicles.

In addition, the NPS is committed to the following design and construction commitments:

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[1] *PM10* refers to particulate matter with a diameter of 10 microns or less. Material of this size is small enough to be drawn deep into the lungs when inhaled and thus poses a human health hazard.

- Restoration and spoils disposal earthwork: *Caltrans Standard Specifications* (California Department of Transportation 1999).
- Structural features for water conveyance: relevant guidance of the American Waterworks Association.
- Other structural features, such as bridge: *Uniform Building Code* (International Conference of Building Officials).

NPS will ensure that design and construction of project features, including earthwork and infrastructure, proceeds in accordance with the appropriate codes and standards.

Measures to Protect Water Quality

Seashore staff and NPS contractors will implement the preferred alternative to abide by the following stipulations in order to protect Water Quality at and downstream of the project Sites:

- Conduct construction activities during the dry season.
- Conduct construction work in accordance with site-specific construction plans that minimize the potential for increased delivery of sediment to surface waters.
- Ensure that concentrated runoff and concentrated discharge are diverted away from channel banks.
- Minimize removal of and damage to native vegetation.
- Install temporary construction fencing to identify areas that require clearing, grading, revegetation, or recontouring, and minimize the extent of areas to be cleared, graded, recontoured, or otherwise disturbed.
- Grade and stabilize spoils sites to minimize erosion and sediment input to surface waters and generation of fugitive dust (see discussions under *Measures to Protect Air Quality* below).
- 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 structures to divert flow around the channel and bank construction area.

Measures to Protect Wildlife

Measures for Migratory Birds

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 (February 15–August 1). To provide additional assurance, the NPS will conduct preconstruction surveys for migratory birds and their nests at the project site no more than 1 week prior to the initiation site preparation, staging, or construction activity planned before August 1. If preconstruction surveys identify active nests belonging to common migratory bird species, a 100-foot exclusion zone will be established around each nest to minimize disturbance-related impacts on nesting birds. If active nests belonging to special-status migratory birds are identified, a no-activity buffer zone will be established around each nest. The radius of the no-activity zone and the duration of exclusion will be determined in consultation with the U.S. Fish and Wildlife Service.

Measures for Aquatic Species

Before de-watering activities begin at the project site, NPS will ensure that native aquatic vertebrates and larger invertebrates are relocated to a flowing channel segment by a qualified fisheries biologist. NPS will work with NOAA Fisheries 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. The construction will occur during a period of time when frog use of these areas would be 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. Frogs that have moved into the area would be captured and relocated to habitat outside of the construction area.

Measures to Protect Vegetation and Prevent the Introduction and Spread of Invasive Plant Species

BMPs to protect riparian vegetation during construction will be incorporated into construction documents (plans and specifications) for the proposed action. They will include, but may not be limited to, the following:

- Requiring the use of temporary construction fencing to delimit work areas. Requiring that fencing be installed before site preparation work or earthwork begins.
- Excluding foot and vehicle traffic from particularly sensitive areas by delimiting exclusion areas with temporary construction fencing and flagging tape in a conspicuous color.
- Washing off the tires or tracks of trucks and equipment entering and leaving project sites to prevent seed transport.

Spill Prevention and Response Plan

The NPS and its contractors will 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;
- spills are cleaned up immediately and appropriate agencies are notified of 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).