Chapter 2
Alternatives

This chapter identifies a range of alternatives that represent technically feasible approaches to meeting the proposed project's stated purpose, and describes the process used by the lead agencies to formulate the range of project alternatives. It presents the environmental and agency constraints and policy, legislation, and site characteristics considered in identifying the alternatives to be carried forward for Final EIS/EIR analysis. The project purpose and need, which also guided alternatives formulation and screening, is discussed in detail in Chapter 1.

NEPA and CEQA Requirements for Alternatives

NEPA and its implementing regulations require that an EIS evaluate a reasonable range of feasible alternatives to the proposed action. Although the No Action Alternative is not the baseline for evaluating environmental effects[1], the EIS must also evaluate the No Action Alternative, to allow decision makers to compare the effects of approving the proposed action with the effects of not approving it. Alternatives must be evaluated in the same level of detail provided for the proposed action (40 CFR 1502.14).

Similarly, CEQA requires that an EIR consider alternatives that would avoid or reduce one or more of the significant impacts identified for the proposed project. Under the state's CEQA Guidelines, the EIR does not need to consider all possible alternatives; rather, the alternatives considered should be limited to a reasonable range that would meet the project objectives, appear to be feasible, and would avoid or substantially lessen at least one of the project's significant environmental effects. Like NEPA, CEQA requires analysis of the No Project Alternative to allow decision makers to assess the effects of not moving forward with the proposed project. CEQA does not require the alternatives to be evaluated in the same level of detail as the proposed project. However, EIRs are required to include sufficient information about each alternative to allow meaningful evaluation, analysis, and comparison with the proposed project or program (CEQA Guidelines Sec. 15126[d], 15126.6[a], 15126.6[f]).

[1] The baseline for impact analysis is defined as environmental conditions at the time the NOI/NOP was published.

Alternatives Formulation Process

Caltrans 1994 Preliminary Environmental Assessment[2]

Preliminary design alternatives for the project site were developed in the early 1990s by Caltrans, working with NPS and other agencies, as mitigation for repair of the Lone Tree Slide on Hwy 1 near Stinson Beach. These alternatives were described in a Preliminary Environmental Assessment (EA) completed for the Caltrans project (Phillip Williams & Associates 1994), which summarized natural conditions and historic changes at Big Lagoon; described existing and anticipated future conditions; and identified restoration objectives. Using these as a basis, opportunities and constraints at the site, including physical, ecological, and land use characteristics, were evaluated, and four Restoration Alternatives were developed for the site:

1. restoring the historic wetland,
2. restoring the historic wetland and preserving riparian woodlands,
3. expanding the backwater ponds into the lower pasture at Green Gulch Farms, and
4. enlarging the tidal lagoon and restoring dunes.

In addition, several parking alternatives were identified but not considered further. The four Restoration Alternatives involved excavation volumes ranging from 3,600 to 120,000 cubic yards, and a preliminary investigation of potential disposal locations for cut materials was also conducted in the EA. However, the project was never implemented.

~~Current~~ Development Process

The GGNRA reinitiated planning for the site in 2002. The current planning effort builds on work completed for the 1994 EA, but incorporates new assumptions and current information. In particular, the project boundaries have been expanded to include 6.75 acres of NPS-owned lands upstream of Pacific Way to allow a fuller integration of channel alternatives; this is intended to reduce flooding on Pacific Way and allow more complete restoration of natural creek function. The current project also includes plans to reconfigure or move the NPS visitor parking lot at Muir Beach and reconfigure the Marin County–owned Pacific Way Bridge over Redwood Creek.

[2] Note that while the 1994 EA was called an "Environmental Assessment," it was not a NEPA document.~~prepared with the intent of fulfilling NEPA requirements.~~

Between December 2002 and December 2004, 17 public meetings were held, as well as a variety of site visits and meetings with representatives of various agencies. On December 3, 2002, a NOI to prepare an EIS was published in the Federal Register, beginning the formal scoping process for the project. The NOI identified goals for the project, and public scoping meetings were held on October 22, October 29, and November 2, 2002, with a site visit for the public held on November 9, 2002, to solicit input on the project and its potential impacts. Following these meetings, a Big Lagoon Working Group consisting of interested individuals, agencies, and organizations was formed to help develop project alternatives. The working group convened regularly in meetings that were open to the public. In addition, two alternatives workshops were held for the public on September 30 and October 4, 2003. The results of those workshops, as well as a more detailed summary of the scoping process, are presented in the Alternatives Public Workshops Report (National Park Service 2004). Finally, Marin County circulated a Notice of Preparation of an Environmental Impact Report on April 27, 2004, soliciting comments on the specific issues to be included in the scope of CEQA environmental review. All of these activities informed the alternatives formulation process.

Concurrent with the activities described above, NPS and other entities have conducted studies and prepared technical documents to develop baseline site information and develop conceptual restoration design alternatives. The Site Analysis Report (Philip Williams and Associates et al. 2003) expanded on the 1994 EA to describe the site in more detail, developing a conceptual model for Big Lagoon's physical and ecological functions prior to disturbance following European colonization; identifying watershed changes and other factors that have led to the site's current condition; and discussing existing conditions at the site. A sediment budget was also developed for the Redwood Creek Watershed comparing historic and current sediment loads to the creek (Stillwater 2004). These and other investigations, together with the public involvement process described above, resulted in the Feasibility Analysis Report (Philip Williams and Associates et al. 2004), which defined more specific strategies, goals, objectives, and indicators for the site, evaluated opportunities and constraints, and presented three ecological Restoration Alternatives and four Public Access Alternatives. These restoration and Public Access Alternatives served as the basis for the alternatives evaluated in the EIS/EIR. Alternatives described in the Feasibility Analysis Report were peer-reviewed by the San Francisco Bay Wetlands Restoration Group, Design Review Group, in early 2004. The peer review comments led to a re-evaluation of whether more minimal restoration actions could be taken, additional proposed actions for the intermittent tidal lagoon, and additional scrutiny of sediment dynamics related to the project function (San Francisco Bay Wetlands Restoration Program, Design Review Group 2004). Public access alternatives were modified from those presented in Philip Williams & Associates et al. (2004) to provide a broad range of alternatives and to reflect additional input from stakeholders.

Over the course of the extensive public outreach process conducted for the Big Lagoon site, numerous other alternatives have been suggested that are not under detailed consideration at this time. A summary of alternatives considered but

eliminated from further study, including the reasons for their dismissal, is presented later in this chapter under the heading *Alternatives Eliminated from Further Study*.

Alternatives Analyzed in Detail

This section presents the range of alternatives analyzed in detail in the EIS/EIR.

As identified above, in addition to No Action (no restoration, no changes in public access), three ecological Restoration Alternatives, six Public Access Alternatives, and four bridge replacement options are under consideration at this time. The project will ultimately consist of one restoration alternative combined with one Public Access Alternative and one bridge design. As shown in Table 2-1, many combinations are possible. However, some combinations have already been ruled out as infeasible because they would combine fundamentally incompatible approaches; for instance, restoration of a large lagoon on the site would be physically incompatible with development of parking located at the beach, so these alternatives would not be combined.

Table 2-1. Possible Combinations and Their Compatibility/Feasibility—Restoration Alternative and Public Access Alternative

	Restoration Alternatives			
Public Access Alternatives	Alternative 1: No Action	Alternative 2: Creek Restoration	Alternative 3: Creek and Small Lagoon Restoration	Alternative 4: Large Lagoon Restoration
A—No Action	**Yes**	No	No	No
B1—50 Cars at Beach	No	**Yes**	**Yes**	Yes[1]
B2—145 Cars at Beach	No	**Yes**	**Yes**	No
B3—175 Cars at Beach	No	**Yes**	**Yes**	No
B4—175 Cars Rotated Parallel to Pacific Way	No	**Yes**	**Yes**	No
B5—200 Cars at Beach	No	**Yes**	**Yes**	No
C—118 Cars at Alder Grove plus 14 Spaces for Disabled and Drop-Off at Beach	No	**Yes**	**Yes**	**Yes**

Notes:

All Bridge and Fill Disposal Alternatives are compatible with the various Public Access and Restoration Alternatives.

Yes = Combination identified as feasible.

No = Combination identified as incompatible/infeasible.

1. Note that while this combination is technically feasible, it is not evaluated in this Final EIS/EIR as it is unlikely to be implemented. Should it be determined in the future that this alternative may be implemented, additional CEQA/NEPA analysis would be necessary.

Several alternatives are also under consideration for disposal of excavated materials (Fill Disposal Alternatives). The construction scenario, and ongoing maintenance and management, would be broadly similar under all alternatives combinations.

The following sections describe the No Action Alternative and the action alternatives. Discussion of the action alternatives includes

- the activities common to all action alternatives (i.e., tasks that would be accomplished under all restoration and public access approaches);
- the three restoration approaches;
- the six public access approaches;
- the four bridge options;
- alternatives for fill disposal;
- construction scenarios; and
- ongoing maintenance and management under the action alternatives.

Alternative 1—No Action

Under the No Action Alternative (Figures 2-1 and 2-2), Redwood Creek would remain in its current alignment, and no large-scale physical modifications of the site would occur. Pacific Way road and bridge would remain unchanged in size and design and would continue to serve as the primary access route to the parking lot, which would also remain unchanged at its current location, as well as for residences along Pacific Way and Lagoon Drive. Visitors would continue to reach the beach via the existing footbridge, and area trails—such as the internal loop trail and access to the southerly Coastal Trail—would remain as they are now. The levee road, currently used as an emergency access route, would remain in place along Redwood Creek from Pacific Way to the toe of the southerly Coastal Trail. The picnic area and restrooms would remain in their current location adjacent to the parking lot.

The No Action Alternative would allow continued periodic flooding of Pacific Way during storm events, resulting in the need for emergency intervention to prevent prolonged road closures. Periodic maintenance, including dredging, would continue to be needed to remove sediment and fallen trees from Redwood Creek, although its implementation would be hindered by the difficulty in obtaining permits from regulatory agencies for such actions. Channel avulsion of Redwood Creek (i.e., sudden relocation of the channel alignment during a large storm) would be likely under this alternative as the existing channel, in its confined condition, continues to aggrade (i.e., build up with sediment) in response to elevated sediment delivery from the watershed. Channel avulsion under the No Action Alternative could create fish passage impediments due to either shallow sheetflows during migration periods and/or the presence of the levee road, which can block reentry of waters to the existing creek channel.

Active seasonal management of the culvert and flashboards in the lower Green Gulch pasture would continue to be necessary to maintain ponded surface water for the CRLF.

In addition, the No Action Alternative provides sub-optimal salmonid habitat due to fragmentation of winter rearing habitat, in-channel conditions lacking refugia, and out-of-bank flows that do not provide for easy salmonid reentry into the main channel.

Without active maintenance of Redwood Creek, the lower reaches of Redwood Creek in its confined state would continue to lose flow capacity as a result of sediment deposition up- and downstream of the Pacific Way Bridge. This would likely result in future increased flooding and difficult access for residents and visitors, the eventual sedimentation of Redwood Creek, and the overall degradation of natural geomorphic processes at the site. The loss of healthy creek processes would undermine the capacity for healthy salmonid habitat.

Action Alternatives

Activities Common to All Action Alternatives

Because all of the Restoration Alternatives focus on reconstructing natural geomorphology and function at the Big Lagoon site, all would be guided by the same strategy, and all would have certain key project elements in common. The same is true for the Public Access Alternatives, all of which stress reduction in hydraulic impacts with improved public access to a functionally and visually restored Big Lagoon site. To avoid redundancy, the following sections present an overview of the strategic and project elements that would be implemented with all action alternatives for restoration and public access.

Restoration Activities Common to All Action Alternatives

Because they are guided by the same goals and objectives, all of the restoration approaches would entail some of the same activities. The activities common to all Restoration Alternatives are described in the following sections.

Interim Flood Reduction Measures

Flood reduction actions by NPS or Marin County are proposed as interim actions common to all alternatives since construction of restoration, public access and bridge components will require up to three years and will not be completed until about 2010 or 2011, depending on funding availability. The interim actions are necessary because ongoing channel aggradation contributes to (1) flooding under low-magnitude, high frequency storm events and (2) the risk of channel avulsion. Frequent out-of-bank flows from Redwood Creek have resulted in side channels that have been eroded in the floodplain upstream of Pacific Way, and the channel is at risk of avulsion in this area (Klein et al. 2002). These conditions will persist

and likely grow worse in the interim period before the larger restoration project is completed.

To address both issues (flooding and risk of avulsion), interim actions are focused on maintaining flow under the Pacific Way Bridge during low magnitude events, since the reduced capacity under the bridge forces flows onto the floodplain (Klein et al. 2002). As of May 2006, the channel bed is about four feet below the bridge soffitt (or lowest part of the bridge). The channel bed elevation increased about 2.5 feet in 2005-06 at the upstream side of the Pacific Way Bridge (Environmental Data Solutions 2006).

Proposed interim flood reduction actions consist of excavating the channel from a maximum of about 400 feet upstream of the Pacific Way Bridge to about 100 feet downstream of the bridge. Up to about 3 feet of material would be excavated from this reach, for a total of about 1,600 cubic yards during a single excavation. A more limited reach of the channel would be excavated if channel bed elevations in this reach are lower than those in 2006. An excavator or similar equipment would be used to remove the sediment. Equipment is expected to be taken into the channel to conduct the excavation.

For purposes of analysis, flood reduction actions at the Pacific Way Bridge are proposed to be conducted two times before construction of the restoration project is completed if the channel bed at the Pacific Way Bridge is about four feet or less below the bridge soffit. Other limited actions would consist of removing sediment within Marin County's 40 foot–wide right-of-way on the upstream and downstream sides of the bridge; this could be done without taking equipment into the creek channel. Interim actions would include removing log jams in the project area only if they are shown to be obstructing flood flows or contributing to sediment aggradation that is worsening flooding or the risk of channel avulsion.

Excavated material would be transported to the unused reservoir pit (described below under the Fill Disposal Alternatives) for temporary storage. Excavated material may be used during the implementation of other project actions, such as when existing reaches of the creek are backfilled following construction of a new channel alignment.

All interim flood reduction actions would be conducted during the low flow period, between August 1~~15~~ and October 31. Cofferdams would be established at the upstream and downstream end of the work areas, to prevent turbidity in downstream areas during the work. Flow downstream of the work areas would be maintained by pumping the creek flow around the work area. Fish would be removed from the work area prior to establishing the coffer dams by using seines, dip nets and electro-fishing methods, and fish nets would be extended across channel both upstream and downstream of the work area to prevent them from re-entering during the work. All fish would be removed and relocated to other locations in Redwood Creek per requirements of the National Marine Fisheries Service (NMFS).

Relocation of Redwood Creek Channel

For each action alternative, the Redwood Creek channel from the upstream project boundary to approximately 100 feet downstream of Pacific Way would be relocated approximately 100–200 feet to the northeast of its existing alignment. The proposed location of the new channel generally follows the topographically lowest portion of the valley, minimizing the potential for future channel avulsion. Because this low point is very close to the Pelican Inn, the new channel would be located approximately 150 feet from the Pelican Inn driveway at Pacific Way. The gradient of the new channel in this location would be tied to the gradient of the channel upstream of the project area. The new creek in this location would be about 5 feet deep and would include low sloping berms to re-create the form of natural depositional levees that would occur in this reach. These low berms would confine bankfull (Q1.5–2)[3] flows upstream of Pacific Way, and support riparian vegetation that would help maintain the channel form, increasing sediment transport and channel sustainability. Most of the existing channel would be back filled upstream of Pacific Way under Alternatives 3 and 4, but most of this reach would not be filled under Alternative 2 to create a backwater channel for use by salmonids and to increase flood storage capacity.

Construction of New Drainage Swale and Upper Pasture Modifications

Under all restoration approaches, a drainage swale would be constructed downstream of Pacific Way between the realigned creek channel and the eastern project boundary. The purpose of the swale would be to collect runoff that would otherwise gather at the base of the eastern berm of the realigned creek. The swale would be very gradually sloped and approximately 1–2 feet deep. It would drain through a new pond with emergent vegetation to Green Gulch tributary under Alternative 2, to the eastern lagoon under Alternative 3, and to the large lagoon under Alternative 4.

Fencing around an equestrian ring on the southwestern side of the access road would be removed under all alternatives, and the area would be revegetated with seasonal wetland vegetation. The ring is currently used by equestrians during the dry season only, but equestrian use of this area would no longer be available. Restoration alternatives do not call for removal of horse stalls on the northeast side of the access road, at the intersection of Hwy 1 and Pacific Way.

Backbeach Lagoon Enhancement, Channel Realignment, and Dune Restoration

In order to enhance the natural dynamic quality of the backbeach lagoon and encourage inland dune formation, all action alternatives would include excavation along the landward side of the intermittently tidal lagoon. The excavation would be approximately 100 feet wide and would encompass the entire length of the lagoon. The excavation depth would be as much as 4 feet, or

[3] "Q" refers to the recurrence interval of the flow event. A Q2 event would be the 2-year recurrence interval flow event, or the flow that has a 50% possibility of happening in any given year. Similarly, a Q100 event would be the 100-year recurrence interval flow event, or the flow that has a 1% possibility of happening in any given year.

somewhat deeper than the roots of the existing vegetation. This would enlarge the lagoon habitat, which is expected to vary in size seasonally and as a result of interannual variation in flows and sediment loads. Wave action and inundation by ponded lagoon water would discourage vegetation establishment, allowing windblown sand to reconstruct the historic dune field.

Each action alternative would also include installation of LWD in the lagoon or at its edge to enhance habitat for juvenile steelhead and salmon by providing additional cover and contributing to development of deeper scour pools. The LWD would consist of large diameter logs with rootwads. A variety of installations would be used, including embedding some logs vertically for stability, leaving some on the surface, and embedding some at an angle.

Additionally, the stream channel downstream of the existing footbridge ~~would~~ may be shifted seaward from its existing location to an alignment consistent with the 1853 map and early aerial photographs of the site. As described in the pre-Euroamerican conceptual model presented by Philip Williams & Associates et al. (2003), high flows in the winter scoured a channel along the back beach to the ocean. With the present location, channel scour is constrained by locally cohesive soils which may be a remnant of dams constructed at that location in the 1960s and 1970s and which were further reinforced by willows and alders that became established there. The new channel would be excavated into more erodible sand to allow for increased channel scour and improved drainage of upstream portions of the site in winter months. Willows, the consolidated soils, and oversized rubble in this area would be removed to regain more natural, less constrained channel processes. The more erodible alignment of the channel downstream of the pedestrian bridge will also enable scouring of the intermittent tidal lagoon. Furthermore, the existing riprap on the left bank of Redwood Creek upstream of the footbridge would be removed to provide added support of natural channel processes.

Each of the three Restoration Alternatives proposes the same improvements to native dune communities by enhancing dune processes between the existing parking lot and tidal lagoon. Under all three restoration approaches, dune enhancement would rely on the possible natural lowering of the water table following excavation of the new creek channel to the tidal lagoon, combined with wind activity to develop dunes from newly dry (hence, erodible) sands. Dunes are most likely to form toward the southeast end of the beach, due to the direction of prevailing winds. Because dunes are sensitive to human and animal trampling, all restoration approaches would use fencing or other means to restrict public access to dune restoration areas. In addition, revegetation of native dune vegetation may be implemented to improve dune formation and quality. New fencing would be installed to allow reestablishment of foredunes, to the south or ocean-side of the existing backdune lobes. With establishment of native foredune vegetation, the foredunes are anticipated to capture fine sand, thereby reducing the sand washed or blown into the new channel.

Removal of Levee Road

The levee road on the northeast side of the creek would be removed under each action alternative to allow lateral channel migration and the ability to reconnect Redwood Creek to its former floodplain. Note that the ultimate function of the former levee road would vary by alternative. All fencing along the levee road, as well as through the Green Gulch pasture, will also be removed.

Invasive Species Removal

All action alternatives would remove invasive non-native plant species . In particular, Cape ivy and non-native invasive perennial grasses, such as kikuyu grass, panic veldt grass, Harding grass, and tall fescue would be removed from various locations at the project site. Nonnative species outside the project boundary that would be likely to spread to the project site would also be targeted for removal, particularly the Harding grass in the alluvial fan south of the project boundary. Himalayan blackberry, the non-native blackberry, and other non-natives would also be targeted for removal.

Cape ivy removal would be prioritized in the approximately 6- to 7-acre alder grove upstream of Pacific Way to preclude its spread into new downstream areas after the channel is realigned. The Green Gulch tributary portion would also be included as part of this first phase. The second priority would be removal in the riparian area adjacent to the parking lot, since this area could be contained temporarily, preventing reestablishment. The total area where Cape ivy removal could be conducted in any one year would be coordinated with the U.S. Fish and Wildlife Service (USFWS) as part of the project's formal consultation for potential impacts on CRLFs. The ivy would be cut and raked, with 3 years of follow-up to remove sprouts. Generally, about 98% of Cape ivy cover is removed in the first year's activities, but 2 years of persistent follow-up is required to ensure eradication of the remaining 2%. Removal would rely on manual techniques; a formal consultation, under Section 7 of the federal Endangered Species Act (ESA), on Cape ivy removal prohibits herbicide use within 150 feet of Coho salmon habitat. The presence of CRLF at the site would likely also preclude herbicide use.

During construction, kikuyu grass would be excavated to rooting depth (approximately 1 foot) at locations where it occurs at the project site, particularly shoreward of the existing parking lot and at the intersection of Green Gulch Trail and the existing levee road, along the levee road, and at more isolated locations around the edges of the site. The removed plants would be composted at a local site or disposed of at an appropriate facility that accepts green waste. This excavation would create additional wetlands in the short-run and, possibly converting to dunes in the long-run with the build-up of wind-blown sand.

Removal of Tavern Remnants

Under all action alternatives, remnants of the non-historic Muir Beach Tavern between the parking lot and the mouth of Redwood Creek/inboard end of the tidal lagoon, in the southwest portion of the project site, would be removed. The remnants include ~~the foundation of the tavern chimney, the remnants of the tavern chimney,~~ concrete sidewalks and a concrete retaining wall or curb along

the northern side of the mouth of Redwood Creek. The tavern chimney would not be removed.

Removal of Utility Lines

Each action alternative would involve the removal and relocation of utility poles and phone and electric lines along the levee road and near Pacific Way. The lines through the wetland area may be placed underground beneath Pacific Way, instead, but utility poles closest to the Pacific Way homes are expected to remain in place. Two poles through the Alder Grove upstream of Pacific Way may also be repositioned to accommodate the new channel alignment. The two existing AT&T utility boxes and their fill pad on the west side of Pacific Way at the southeast end of the proposed bridge would be moved to a serviceable location determined in coordination with AT&T during the project design. Additionally, the Muir Beach Community Services District (MBCSD) water line that runs along the upstream side of Pacific Way and beneath the existing Pacific Way Bridge would be attached to the new bridge. Finally, a decommissioned well pump and associated aboveground power lines across Green Gulch pasture would be removed. The well pump is located along the levee road upstream of the footbridge, and the lines extend from this location to the east corner of the project site.

Removal of Concrete Channels and Revetment

Under each action alternative, gabions and other channel armoring upstream of the existing footbridge would be removed to allow the restored channel to migrate more naturally. In addition, concrete channels ~~along Green Gulch Creek and~~ in the unnamed tributary in the project area would be removed, as would the concrete weir structure controlling flows between the existing emergent wetlands and Redwood Creek channel and the culvert from Green Gulch Creek under the levee road to Redwood Creek.

Modifications to Green Gulch Field 7

The project boundary for all alternatives runs through the lower portion of Green Gulch Field 7, where Ocean Riders currently pasture four horses under an agreement with the San Francisco Zen Center. Under all alternatives, the windrow of Monterey cypress trees on the southwest edge of the field would be removed. Some of these tree trunks may be large enough for reuse as LWD to benefit salmonids and would be retained for this purpose. Fencing around the perimeter of Field 7 will be adjusted to reflect the new project boundaries. An existing horse shelter would be relocated in the new boundary of Field 7. The boundary adjustment for Field 7 would reduce available area for horse pasturing by about 25%, and would likely lead to the loss of pasture for one of Ocean Rider's horses in Field 7.

Cultural Resource Enhancement

The core cultural resource goal of the wetland and creek restoration at Big Lagoon is to incorporate cultural heritage values and sites of the Coast Miwok into the restoration design, visitor experience, and long term management of the project area. Research has demonstrated that Coast Miwok people have lived around the lower reaches and mouth of the Redwood Creek as long as the estuary

itself. The practices of daily life and subsistence resulted in a selective process that formed part of the ecology of the locale. Retrieving and using part of this cultural ecology will be sought for the design, management, and interpretation of the ecological restoration of the Big Lagoon area.

A traditional ecological knowledge study will be prepared in consultation with the Federated Indians of Graton Rancheria to compile and analyze the archeological, ethnographic, and ethnohistoric data available to provide cultural ecological data to the restoration design. The study will consider relevant information from the Central California ethnographic region.

Removal of the Lower End of Existing Parking Lot and Picnic Area

All restoration alternatives incorporate the removal of at least the southeast end of the existing parking lot, including the picnic area, to improve hydraulic conveyance of the creek. At least 90 feet of the length of the parking lot and picnic area combined would be removed, because hydraulic models show it is the lower end of the parking lot and picnic area that causes almost all of the impact to creek flows in its current configuration. Public Access Alternatives evaluate a range of options for the new parking lot and picnic area design.

Mosquito Management

All action alternatives and the No Action Alternative contain habitat features that could support mosquito breeding. Information would be provided to visitors and residents on how to reduce exposure to mosquitoes (e.g., wearing long-sleeved shirts). Monitoring for larval mosquitoes will occur when surface water is present. Should numbers be present at levels sufficient to pose public health risks, the Park's IPM coordinator will treat the ponded areas with a biological control agent (*Bacillus thuringensis*), which is commonly used and does not impact other aquatic life. In the long term, colonization of the created wetland habitat by predatory insects should also assist with reducing the risk posed by mosquitoes.

Public Access Activities Common to All Action Alternatives

Like the three restoration approaches, the six public access approaches are guided by the same set of goals and objectives, and would have several activities in common with one another. These common activities are described in the following sections.

Location of Visitor Facilities at the Beach

Each action alternative would involve the removal of at least the southeast end of the existing parking lot, including the 7,375–square foot picnic area. NPS has previously removed approximately 2–3 feet of fill from 4,275 square feet of the picnic area, and the remainder of the picnic area would be subjected to similar excavation to restore natural floodplain elevations throughout this location. Consequently, all of the parking lot options would be set back at least 90 feet

from the existing east boundary of the lot to allow added flow conveyance during storms (Philip Williams & Associates et al. 2004).

The existing picnic area and restroom facilities at the east edge of the parking lot would be relocated to the west, remaining adjacent to the new parking lot or drop-off area. The relocated picnic area will be constructed adjacent to the parking lot to provide a visitor resource that is compatible with a natural area. The size of the picnic area will be large enough to accommodate about 10 picnic tables, with sufficient room for school groups, hiking groups and others that often gather in the area. It is expected to be between about 3,500 and 5,500 square feet.

The picnic area will be located at a distance from the local residences to minimize noise and other disturbance. However, since trash cans must be easily accessible to vehicles operated by maintenance personnel, the picnic area will be linked to the parking lot. Grills will be provided to encourage visitors to use safe practices for outdoor cooking.

The existing portable chemical toilets will be removed and replaced with new restroom facilities, such as vault toilets, which are housed in a permanent structure and are designed and maintained so that the interior is odor free. The new accessible toilets will be constructed in a location that minimizes impacts to visual, natural and cultural resources as well as potential impacts to adjacent residences and other visitor uses.

A conceptual layout or design for the picnic area has not been prepared for this Final EIS/EIR, but it will follow all requirements for ADA accessibility, including ADA-accessible picnic tables. The picnic area will be constructed on a fill pad to provide an area that will not be too wet for use throughout much of the year, but any fill placed or relocated for this purpose will be designed to avoid creating a hydraulic obstruction. Designs will factor in features that may increase privacy from adjacent cars and wind protection.

Pedestrian Access from Hwy 1

Each action alternative would include a pedestrian trail along Pacific Way from Hwy 1 to the beach parking lot/drop-off. The trail would be about 5 feet wide, except along the new Pacific Way Bridge where it would widen to 6~~8~~ feet. Portions of the trail between the bridge and the parking lot/drop-off would be built on fill newly placed over the edge of the existing creek channel. Most of the existing Monterey pines that line the east side of Pacific Way would remain, continuing to provide fall roosting sites for monarch butterflies and preventing unauthorized use of the trail for parking, although two pines would be removed for a new entry to Public Access Alternative B4, and the existing pine that is at the corner of Pacific Way and Hwy 1 may need to be removed to provide for the pedestrian trail. The new trail between the bridge and the parking lot would be separated from the road by a 5 foot–wide buffer, and could also be grade-separated from the road by approximately 1 foot. From the bridge to Hwy 1, the trail would be adjacent to the road and would be incorporated into the embankment of the newly raised portions of Pacific Way. The surface, width and slopes of the trail will meet ADA standards newly adopted by NPS in 2006.

Pedestrian Access to Beach

Under all action alternatives, a pedestrian boardwalk and bridge crossing of Redwood Creek would extend from the new parking lot to the beach. The exact locations of the boardwalk and bridge have not been determined at this time; final location and design characteristics would be defined in project design with a performance standard of minimizing adverse impacts to channel form, hydraulic processes, habitat and providing a quality visitor experience.

For the purposes of illustrating the boardwalk and bridge, each Public Access Alternative shows one of two options for location. The two options presented represent the limits within which the boardwalk and bridge would be located. The first option shown is a boardwalk originating from the parking lot/drop-off and extending seaward across the wetland and tidal lagoon. The second option shown is a boardwalk originating from the parking lot/drop-off and extending in the direction of the existing pedestrian footbridge over the creek. Under the second option, visitors would continue through the dunes to reach the beach.

Interpretive Displays

All of the action alternatives would include interpretive displays located at the southeast corner of the parking lot or drop-off, adjacent to the picnic area and restroom facilities; and at the confluence of the Coastal Trail and Green Gulch Trail. Public Access Alternative C would include an additional interpretive display at the Alder Grove parking lot.

In addition, under all alternatives, an interpretive blind/overlook for bird watching could be constructed. The location would vary, depending on the alternative. The location for blinds or overlooks would be placed to minimize the potential for adverse impacts.

New Emergency Access Route

Each action alternative includes an emergency access route from Pacific Way along the current access road to Green Gulch Farm to the southern project boundary. This route would replace the levee road for emergency access to the Coastal Trail and Coyote Ridge. The existing trail at this location was originally built to be 12 feet wide, but vegetation has encroached on both sides of the trail so that it is currently only functioning at about 6 feet wide. Under each action alternative, the encroaching vegetation would be removed and minor recontouring would be conducted at the toe of the slope to convert the trail into a functional 12 foot–wide unpaved road. The road would be outsloped to a 1% grade to improve drainage in areas with minor drainage problems. Only small quantities of fill would be used to develop the road, which would remain unpaved. An area large enough for about three vehicles to pull in side-by-side would be constructed as a turnaround or staging area for emergency vehicles at approximately the current location of the intersection of the levee road and the Coastal Trail. A bridge crossing at the southern end of the Green Gulch pasture would be improved to facilitate vehicle passage. A new padlocked gate on the access road near Pacific Way would prevent visitors from driving down the road. However, the road would still be accessible to Green Gulch Farm, which would use it to travel to and from the Golden Gate Dairy.

Interpretation During Construction

Under all alternatives, interpretive facilities would be provided to allow for increased education and public awareness regarding the project activities. These would consist of interpretive signage and possible kiosks located at strategic locations frequented by visitors, adjacent to the restoration, public access, and fill disposal activities.

Restoration Alternatives

The following sections describe the three alternative restoration approaches identified as feasible for the Big Lagoon site. As discussed above (see *Restoration Activities Common to All Action Alternatives*), all of the Restoration Alternatives would have key elements in common; accordingly, this discussion focuses on differences in scope and priorities between the alternatives. The following discussion is intended to provide a general overview of the alternatives. More detail regarding the hydraulic modeling for restoration alternatives is provided in Section 4.3.1.1, *Watershed Processes*, of Chapter 4. More specific information regarding each alternative, including the basis for design, is provided in the Feasibility Analysis Report (Philip Williams & Associates et al. 2004).

The project planning horizon is 50 years. Under all of the Restoration Alternatives, conditions at the Big Lagoon site are expected to change substantially over the 50 years following restoration, as natural geomorphic, hydrologic, and successional processes operate. Consequently, the alternatives are described both in terms of the time period immediately following restoration (Year 5) and at Year 50.

Alternative 2—Creek Restoration (Preferred)

Alternative Characteristics

Alternative 2 (Figures 2-3 through 2-5) would involve relocating approximately 2,500~~2,000~~ linear feet of Redwood Creek to the topographically lowest portion of the valley, while maintaining a habitat mix similar to current conditions. Creek relocation and restoration would be designed and graded to remove existing hydraulic constraints and minimize the need for ongoing maintenance. The new channel would include low sloping banks slightly higher than the adjacent floodplain to simulate the natural depositional levees that would occur in this reach. These low berms upstream of Pacific Way would accommodate bankfull flows, maintain the low flow channel, and support riparian vegetation, thus increasing sediment transport and channel sustainability. Downstream of Pacific Way, the lower 400 linear feet of channel would be designed to accommodate more frequent out-of-bank flows of at least a 1-year frequency to create frequent floodplain habitat for salmonids. The Alternative 2 design proposed in this report incorporates modifications to the Alternative 2 analyzed in the Feasibility

Analysis Report (Philip Williams & Associates 2004) to provide better winter rearing habitat for salmonids.

The new channel would begin near the upstream project boundary, traverse the alder grove upstream of Pacific Way and Green Gulch pasture, and rejoin the existing creek channel near the downstream end of the existing borrow channel near the current parking lot. Upstream of Pacific Way, the channel would be approximately 5 feet deep and 30 to 35 feet wide and would be sized to convey bankfull flow of about 560 to 800 cubic feet per second (cfs), estimated by the 1.5 to 2-year return period. Downstream of Pacific Way, the channel dimensions may be reduced to convey approximately a 1-year flow of about ~~300~~ 250-300 cfs to increase the frequency of out-of-bank flows, thereby providing annual winter refugia and floodplain feeding ground for salmonids. The low sloping berms on the banks of the channel downstream of Pacific Way are not necessary to convey bankfull flows but to help ensure channel definition that could otherwise be lost to cattail invasion; berms either would not be constructed or would be discontinuous in the lower 400 linear feet of this reach. Most of the existing primary channel of Redwood Creek upstream of Pacific Way would be not be filled to retain its function as backwater habitat for salmonids. At least two connections to the mainstem channel would be constructed in this reach. Two reaches of the channel downstream of Pacific Way, one near the parking lot and the other in the lowest portion of the pilot channel downstream of the pedestrian bridge, would also remain unfilled and connected to the new channel to provide backwater habitat. In the case of the pilot channel downstream of the pedestrian bridge, it is possible that no channel realignment would be necessary, and this portion of the channel would continue to serve as the mainstem rather than backwater habitat. An existing secondary channel near the levee road would also be retained to function as a backwater channel. This backwater channel would be lengthened to the northwest along the current route of the levee road. The area adjacent to this backwater ~~will~~ may be graded to an elevation slightly deeper than the existing grade to expand available floodplain habitat during base and peak winter flows. In addition, the parking lot and picnic area to be removed may be graded to allow annual winter overbank flow, although those grades were not included in the hydraulic analysis.

The Redwood Creek tributaries from Green Gulch would have their concrete lining removed and would join Redwood Creek in approximately the same location as the existing culvert connections, to minimize disturbance to existing wetlands. Also, because Redwood Creek modifications are expected to lower groundwater levels, two areas would be excavated to create emergent wetland habitat. One emergent wetland area would be in the upper pasture, and the other emergent wetland area would be at the downstream end of the Green Gulch tributaries, and outside the boundaries of existing cattail habitat. The excavated wetland areas would have gradual slopes to provide suitable habitat conditions for the CRLF under the expected range of groundwater levels. The two tributaries from Green Gulch would be realigned and allowed to dissipate into the newly excavated wetland, mirroring historic conditions in which the Green Gulch drainage was not connected to the main channel. Concrete lining in the southern-most Green Gulch drainage channel would be removed.

The existing wetland areas at the southern corner of the pasture would be left undisturbed to minimize potential for disturbance of CRLF. During the detailed design phase, the exact location of wetland excavation, Green Gulch tributaries and Redwood Creek confluence would be refined to minimize impacts to wetland vegetation that supports CRLF.

Ecological Restoration Features

Under Alternative 2, much of the site is expected to evolve from degraded wetlands to mature riparian wetland forest due to lowering of the groundwater table in the Green Gulch pasture, which results from a more natural channel depth. The site would be graded to promote establishment and maintenance of approximately twice the existing acreage of riparian wetland vegetation, with a decrease in seasonal wetland acreage in the Green Gulch pasture area compared to the No Action Alternative. The narrow size of the creek channel downstream of Pacific Way would mimic natural systems that often lose capacity towards their mouths, and would increase the frequency of floodplain inundation without adding to the risk of a channel avulsion before the riparian corridor is established.

During the early phases of this alternative (approximately Year 5), it is expected that the new riparian wetland vegetation would have established, but would not have matured sufficiently to produce significant shading of the creek channel, or offer high-quality habitat for nesting riparian birds. By Year 50, the new riparian areas downstream of Pacific Way would have matured, providing many ecological functions such as stream shading, sources of LWD and leaf litter input to the aquatic ecosystem, and habitat for various terrestrial riparian wildlife species. Emergent marsh habitat in Green Gulch pasture would be lost due to sediment deposition. Some refinements to the marsh during its design could slow the rate of sediment deposition there.

Alternative 3—Creek and Small Lagoon Restoration

Alternative Characteristics

Alternative 3 (Figures 2-6 through 2-8) seeks to combine riparian restoration components with restoration of open water and wetland habitats. As with Alternative 2, Redwood Creek would be realigned from near the upstream project boundary, through Green Gulch pasture, to the existing creek channel near the downstream end of the existing borrow channel. However, unlike Alternative 2, Alternative 3 would include the creation of two open-water lagoons, one on either side of the new channel. The two small lagoons would be backwaters, connected to the creek near the downstream end of each lagoon.

The banks of the lagoons would have varied slopes to favor a variety of habitats. In general, the lagoon to the west of the new channel would have steeper banks to encourage riparian vegetation and the lagoon to the east would have gentle slopes to promote wetland vegetation. The lagoon to the west would be excavated to connect to the borrow ditch channel, while preserving existing riparian vegetation on the west creek bank to the extent possible. The lagoons would maintain a minimum water depth of 3–4 feet year-round.

Ecological Restoration Features

Alternative 3 would initially restore a small lagoon system consisting of both open water and emergent wetlands; of all the alternatives, Alternative 3 would provide the most emergent wetlands that would be sustained over time through natural infilling of the two small lagoons. As described for Alternative 2, a small initial loss of existing riparian habitat just downstream of Pacific Way would occur to accommodate the new creek channel. Also, as with Alternative 2, the brackish marsh area between the existing parking lot and tidal lagoon would disappear by Year 50 due to natural sand deposits, providing an area for additional dune evolution.

Alternative 3 would provide the largest increase of off-channel winter rearing habitat for coho salmon and steelhead of all the alternatives. However, this condition would be temporary, and over the 50-year planning horizon, the two small lagoons would be expected to fill in with 3–4 feet of sediment, replacing much of the open water habitat with emergent wetland. By Year 50, the landscape is expected to evolve to be similar to Alternative 2 at Year 0, including a persistent backwater channel along the western bank of the western small lagoon, but with more shallow wetlands in the filled lagoon areas.

Alternative 4—Large Lagoon Restoration

Alternative Characteristics

Alternative 4 (Figures 2-9 through 2-11) would create a periodically brackish open-water habitat similar to historic (1853) conditions, modified to reflect existing constraints of Pacific Way and private property. This alternative would involve the creation of a large lagoon with fringing wetlands extending to the edge of the valley immediately landward of Muir Beach. As with Alternatives 2 and 3, Redwood Creek would be realigned from near the upstream project boundary to approximately 225 feet south of Pacific Way, where the lagoon would begin. The seasonally brackish lagoon would approximate the configuration of the historic Big Lagoon, except that it would be constructed with 100-foot minimum setbacks from existing constraints such as the modified parking lot footprint, Pacific Way, and upland areas of Green Gulch pasture. Consequently, the restored lagoon would be slightly smaller than the historic Big Lagoon.

The lagoon would be excavated with gentle side slopes to encourage colonization of emergent wetland vegetation. Like the small lagoons under Alternative 3, the large lagoon would maintain a minimum water depth of 3–4 feet year-round.

Ecological Restoration Features

Alternative 4 would initially create a large lagoon system comprised of open water fringed by emergent wetlands. The removal of hydraulic constraints and the relatively larger excavation of sediment would provide the greatest opportunity of all the alternatives for the system to evolve on its own in a state of equilibrium. By Year 50, it is expected that roughly half of the lagoon would be

filled, forming a delta at the mouth of the creek and raising the bottom elevation by roughly 2 feet.

At Year 5, the large lagoon under Alternative 4 would provide more open water habitat and more salmonid rearing habitat than other alternatives. By Year 50, the riparian areas around the Redwood Creek channel would have matured, providing a contiguous riparian corridor until the creek empties into the lagoon. Periodic saltwater intrusion into the lagoon would allow for some brackish marsh plant species to persist along the lagoon fringes.

Table 2-2a shows the acreages of various habitat types at Years 5 and 50 under the action alternatives, with the No Action Alternative presented for comparison. Table 2-2b shows the extent of change in riparian habitat under the various Public Access Alternatives, and Table 2-2c shows the extent of change in riparian habitat under the various Bridge Alternatives compared to existing conditions. Note that these acreages are approximate; due to dynamic conditions at the site, actual acreages may vary from those presented here, particularly at Year 50.

Table 2-2a. Projected Approximate Acreage of Habitat Types for Each Restoration Alternative at Year 5 and Year 50

	Restoration Alternatives at Year 5 (Approximate Acres)				Restoration Alternatives at Year 50 (Approximate Acres)			
Habitat Type	1	2	3	4	1	2	3	4
Open Water	2.4	3.8	6.7	11.6	2.4	2.7	2.6	7.0
Emergent Wetland	13.3	3.4	4.7	4.7	13.3	2.8	8.2	5.1
New Riparian Wetland	0.0	10.6	6.0	4.2	0.0	0.0	0.0	0.0
Mature Riparian Wetland	13.2	10.5	10.9	7.8	13.2	21.6	16.3	15
Dune Habitat	0.1	0.7	0.7	0.7	0.1	2.1	2.1	2.1

Note: Acreage calculations assume existing parking lot and bridge/roadway.

Table 2-2b. Projected Approximate Change in Riparian Wetland Extent Relative to Existing Conditions for Each Public Access Alternative at Year 5 and Year 50

Change in Riparian Wetland Extent for Public Access Alternatives (Approximate Acres)					
B1	B2	B3	B4	B5	C
Change in **New** Riparian Habitat Areas at **Year 5**					
0.90	0.32	0.40	0.90	0.32	0.97
Change in **Mature** Riparian Habitat Areas at **Year 5**					
-0.15	-0.15	-0.65	-1.18 ~~-1.24~~	-1.03	-1.18
Change in **Mature** Riparian Habitat Areas at **Year 50**					
0.75	0.17	-0.25	-0.28 ~~-0.34~~	-0.71	-0.21

Table 2-2c. Projected Approximate Change in Riparian Wetland Extent Relative to Existing Conditions for Each Bridge Alternative

Change in Riparian Extent for Bridge Alternatives (Approximate Acres)			
BR1	BR2	BR3	BR4
-0.32	-0.12	-0.30	-0.28

Predictions of site conditions at Year 50 were based on projected future sediment delivery rates and deposition patterns at the site. Predicting geomorphic changes over a 50-year time scale requires a number of simplifying assumptions and is subject to considerable uncertainties, especially in a system like Redwood Creek where there is a short record of actual sediment transport measurements. Annual sediment delivery rates were based on Stillwater (2004); however, given the various uncertainties, a reasonable estimate of error is likely in the range of plus or minus 25–50%. In other words, the 50-year site condition shown in this Final EIS/EIR may actually occur substantially before or after Year 50. The degree to which altered assumptions affect the rate of site evolution would vary by alternative.

In addition, sediment delivery is expected to be episodic, because sporadic or intermittent events such as fire, El Niño patterns, and large storms will probably play the dominant role in shaping site geomorphology. Such events could cause responses such as channel avulsion or other important geomorphic changes at the site; however, because of the uncertainty surrounding such events, average sediment inputs were assumed. Moreover, all of the Restoration Alternatives will be designed to take advantage of the natural geomorphic processes that shape site evolution, and because they each focus on returning stable conditions at the site, substantial deviations from the projections given here are considered unlikely. For instance, because the realigned stream channel upstream of Pacific Way

would be located at the low point of the valley, the potential for the channel to avulse is considered low.

Table 2-3 shows a sensitivity analysis of the longevity of the alternatives given changed assumptions regarding average sediment delivery rates, episodic events, and trapping efficiency. The table identifies the year in which Year 50 conditions would be realized based on changed assumptions. Note that a given set of changed assumptions affect project lifetime of each restoration alternative to the same extent.

For example, if average sediment delivery assumptions were reduced to reflect pre-1840 conditions, sedimentation of the site would be slowed such that the Year 50 condition as depicted in the project figures would not occur until Year 229. Similarly, assuming that wet years only occur 5% of the years reduces sediment delivery assumptions such that the Year 50 condition would not occur until Year 54. In summary, changing the assumptions regarding sediment delivery to, and trapping efficiency at, the site results in changed predictions regarding rates of sedimentation and hence future site conditions, or more specifically, the period of time that would elapse before the conditions as depicted on the Year 50 drawings would actually occur.

Table 2-3. Project Lifetime Under Various Scenarios

Scenario	Project Lifetime (years)
Baseline Scenario[1]	50
Average Sediment Delivery Volume[2]	
Pre-1840 conditions	229
1841–1920 conditions	26
1921–1980 conditions	24
1981–2002 conditions	44
Episodic Sediment Delivery Frequency – Frequency of Wet Years[3]	
Low (1 per 20 years)	54
1920–1970 conditions (1 per decade)	45
1970–2000 conditions (2 per decade)	33
High (3 per decade)	26
Trapping Efficiency Assumptions	
120% of Baseline Scenario	42
80% of Baseline Scenario	63

Notes:

1 From Philip Williams & Associates et al. 2004.

2 Used sediment delivery rates from Stillwater (2004).

3 Used sediment yield for low flow, average and high flow years from Table 27 of Stillwater (2004), attenuated to match future sediment delivery rate predictions from Stillwater (2004). Assumed average and low flow years were evenly split. Project lifetime likely biased downwards as a result of use of water year 1982 as representative wet year.

Public Access Alternatives

The following sections describe the six Public Access Alternatives identified as feasible for the Big Lagoon site. As discussed above (see *Restoration Activities Common to All Action Alternatives*), all of the Public Access Alternatives would have key elements in common; accordingly, this discussion focuses on differences in scope and priorities between the alternatives. The boundaries of all parking lot alternatives were drawn within an area defined through the use of a hydraulic model to avoid impacts to creek flow conveyance and upstream flooding during high flows. Hydraulic models showed that flows in the creek, in its current alignment and confined state, impact almost the entire lower end of the parking lot and picnic area.

Under Public Access Alternatives B1 through B5, the parking lot would remain at the beach in generally the same area as the existing lot. All visitors would arrive at the beach parking lot and have direct access to the beach along a boardwalk.

Under Public Access Alternative C, the existing parking lot at the beach would be removed and a new lot would be constructed at Alder Grove. Only parking for persons with disabilities and a drop-off/turnaround would be located at the beach under this alternative.

Public transit pull-offs or turnarounds are not proposed as part of this project. They are shown in figures for informational purposes only; they were considered at one time under the Comprehensive Transportation Management Plan (CTMP) for Parklands in Southern Marin, which is no longer active. However, other County plans are underway to improve public transit pull-offs on Hwy 1. The only exception is Public Access Alternative C, which would include a drop-off/turnaround.

Under all of the Public Access Alternatives, the parking lots would be configured to include dense native tree cover and/or native herbaceous vegetation in 5–foot wide planting bays, or swales, between the rows of parking and in planting islands separating groups of vehicles. The parking lot would be unpaved under all alternatives.

Note that the figures depicting the Public Access Alternatives (Figures 2-12 through 2-17) show each matched with a restoration alternative; however, the Public Access Alternatives could be matched with other restoration alternatives as shown on Table 2-1.

Alternative A—No Action, 175 Cars at Beach

Under the No Action alternative, the parking lot would retain is 175-car capacity and current configuration, without vegetated drainage swales. The existing parking lot is 63,000 square feet.

Alternative B1—50 Cars at Beach

Public Access Alternative B1 would construct a 50-space parking lot at the beach at the site of the existing parking lot (Figure 2-12). The parking lot would have an area of 23,510 square feet.

Alternative B2—145 Cars at Beach

The 49,175-square foot parking lot under Public Access Alternative B2 would be similar in configuration to Alternative B1, but would extend further eastward to

accommodate a maximum of 145 vehicles (Figure 2-13). Only the lower 90 feet of the existing parking lot and picnic area would be removed, in order to allow improved creek flow conveyance. If a drop-off/turnaround were added to this area in the future, it would eliminate about 30 of the 145 parking spaces in the lot.

Alternative B3—175 Cars at Beach

Public Access Alternative B3 would accommodate a maximum of 175 vehicles, the same number as the existing parking lot. As shown in Figure 2-14, the lot would be similar in shape and extent to the lot under Alternative B2, but would extend further northward into existing riparian habitat and would be somewhat further from the creek. At 62,200 square feet, the lot would be about the same size as the existing parking lot. In addition to the lower parking lot and picnic area that would be removed under all Restoration Alternatives, additional area of the existing parking lot would be removed. The added length of the lot to be removed ranges from 16 feet at the northeast end of the lot to 40 feet at the southeast end of the lot. The distance of the parking lot from the creek bank in the vicinity of the parking lot would be about 180 feet at a minimum up to a maximum of 240 feet.

Alternative B4—175 Cars Rotated Parallel to Pacific Way (Preferred)

The parking lot under Public Access Alternative B4 would have the same 175-car capacity as Alternative B3, but would be rotated parallel to Pacific Way (Figure 2-15). This 71,445-square foot lot would include a new turn-off from Pacific Way and would include 310 linear feet of stacking room for cars between the entrance and the first parking stall. This alternative would involve removal of two to three Monterey pines along Pacific Way where the new entrance to the parking lot would be built. The distance of the parking lot from the creek bank would be about 350 feet.

Alternative B5—200 Cars at Beach

Public Access Alternative B5 proposes the largest parking lot of all the alternatives, at 87,418 square feet and a maximum of 200 vehicle spaces. As shown in Figure 2-16, the parking lot would be located in the same area as Alternatives B1 through B4.

Alternative C—118 Cars at Alder Grove plus 14 Parking Spaces for Disabled and Drop-off at Beach

Under Public Access Alternative C, a new parking lot would be constructed at Alder Grove along Hwy 1, north of Pacific Way (Figure 2-17). This parking lot would have an area of 41,800 square feet and would accommodate a maximum of 118 vehicles. Pedestrians would walk the 0.5 mile from the lot to the beach on a new trail through the alder grove that would be developed as part of this alternative. Additionally, a 20,805–square foot area on the footprint of the existing parking lot at the beach would accommodate 14 parking spaces for persons with disabilities and a drop-off/turnaround. This alternative would require relocation of several utility poles located near the new parking lot on Hwy 1 to allow a sufficient line-of-sight for vehicles entering and exiting the lot. The parking lot would be generally visible from Hwy 1 through a 25-foot deep screen of trees. In addition, a boardwalk along the eastern edge of the lagoon could be constructed under this alternative.

Bridge Alternatives

The Bridge Alternatives are shown on Figures 2-18 through 2-22, and described on Table 2-4 and in the text below. It should be noted that changes were made to Bridge Alternative BR4 between the Draft and Final EIS/EIR. These changes are discussed below. Although all action alternatives are analyzed to assume a maximum deck width of up to 32~~36~~ feet, including 6~~8~~ feet for a pedestrian path, it is expected that designs will incorporate a somewhat narrower deck width. They would all be centered on the new creek alignment and would span the floodplain. The bridge replacement would involve removal of many trees that line Pacific Way to allow clearance for construction.

The analysis of the road approaches assumes a slightly wider road than the existing road—25 rather than 20 feet Three alternatives include a raised road at either end of the new bridge. Assuming a 25 foot–wide road, with 3:1 side slopes, resulting in a total footprint of approximately 40–50 feet, the length of the raised approaches and the total footprint of the road embankment varies by alternatives, as shown in Figures 2-19 through 2-21.

Table 2-4. Bridge Alternative Characteristics

Bridge Alternative	Bridge Deck Height (feet NGVD)	Bridge Span (feet)	Road Elevation (feet NGVD)	Estimated Fill Volume to Raise Road (cubic yards)
BR0 (No Action)	15.2	24	~11 to 15.2	n/a
BR1	16.5	50	15.5 to 16.5	2,000
BR2	15.0	50	~11 to 15	400
BR3	16.25	150	15.5 to 16.25	1,000
BR4	~16.25 to 18.0	250~~266 to 300~~	~15 to 18	1,110

All alternatives would be designed to be aesthetically compatible with site character, meet Marin County's bridge standards, include an ADA accessible pedestrian path on the downstream side, and contain rails that minimize blockage of infrequent high stream flows which could overtop the bridge deck. While detailed bridge designs have not been developed to date, all Bridge Alternatives would be designed to be as visually unobtrusive as possible, and be of a design and color that is compatible with the surrounding landscape character.

Alternative BR0—No Project

Under the No Project Alternative, the existing bridge would remain. The existing bridge has an approximately 24-foot span with a deck elevation of 15.2 feet NGVD.

Alternative BR1—50 Foot–Long Bridge with a Raised Road

The short bridge spans the new 35 foot–wide channel with a deck at 16.5 feet NGVD. To gain access to the deck, the elevation of the north and south approaches would be raised by as much as five feet to 15.5 feet NGVD. This grading would include elevation changes on the northeastern side to integrate with the grades of the new emergency access road. Due to the limited height, this bridge is designed to account for overtopping during severe flood events, yet to remain passable during routine events. The bridge would be free-span and would not need supporting piers.

Alternative BR2—50 Foot–Long Bridge with a Low Road

Similar to Alternative 1, this short bridge spans the 35 foot–wide channel. The deck height, however, is lower at approximately 15 feet NGVD (similar to the existing bridge) and would not require extensive elevation changes for the

approach. The approaches would range from 11 to 15 feet NGVD. The bridge would be free-span and would not need supporting piers.

Alternative BR3—150 Foot–Long Bridge with Raised Road

This bridge would be longer than Alternatives BR1 and BR2 and would both span the new 35 foot–wide channel and areas of riparian habitat and flood plain on either side of the channel. The bridge span would provide for the same available floodplain passage as the existing condition, which is currently defined by the area between the Pelican Inn fill pad and a fill pad for AT&T utility boxes, which together eliminate about 200 feet of floodplain width. For the purposes of this analysis, it is assumed that 2 foot–wide piers, placed at approximately 40-foot intervals, would be used to support the span and allow for channel migration. The bridge height would be about 16.25 NGVD, compared to the elevation of Hwy 1 at about 16.5 NGVD. Piers would not be placed in the active channel. Grading would tie into the approach from Hwy 1 and to the new emergency access road. Grade changes would begin at Hwy 1 and increase closer to the bridge. The ramp to the new bridge would begin just south of the entrance to the Pelican Inn.

Alternative BR4—250 (reduced from 266 to 300 feet) Foot–Long Bridge with Highest Road (Preferred)

This alternative would be the longest bridge, and would span the entire riparian zone and floodplain from the Pelican Inn on the north to the existing bridge on the south. This bridge would have the highest deck of all the alternatives, between 16.25 and 18 feet NGVD, compared to the elevation of Hwy 1 at about 16.5 feet NGVD (exact bridge height to be determined during the design phase based on design constraints). Based on conceptual design conducted as part of this Final EIS/EIR, Bridge Alternative BR4 has been slightly reduced in length compared with the alternatives described in the Draft EIS/EIR, from 266–300 feet to 250 feet. For purposes of analysis, as in Alternative BR3, two foot–wide piers, placed at approximately 40-foot intervals, would be used to support the span. To allow for channel migration, piers would not be placed in the active channel.

Fill Disposal Alternatives

The Restoration and Public Access Alternatives would generate various amounts of fill as a result of excavation during restoration and construction, as shown in Tables 2-5 and 2-6. The Fill Disposal Alternatives address the issue of how to reuse and/or dispose of the generated fill.

Under all alternatives, fill would be reused on-site where needed for project actions, thereby reducing the need for off-site use or disposal. However, some

off-site disposal would still be necessary, and several alternative locations for fill disposal have been considered. These locations include an unused reservoir pit on NPS property north of the site, near Hwy 1 (the “Unused Reservoir Pit”); a flat field on NPS property known as Upper Banducci Field, and the former Hamilton Air Force Base in Novato. In addition, three other sites have been identified as possible fill disposal locations; these sites are analyzed programmatically in this Final EIS/EIR; if they are selected at a later date, further NEPA analysis would be required. All of the fill disposal sites are summarized in Table 2-7, and further described in the sections that follow. The three fill disposal sites analyzed at a project level in this Final EIS/EIR are also shown in Figure 2-23. Note that where a single fill disposal alternative would not accommodate the entire quantity of fill generated by a given set of restoration and Public Access Alternatives, a combination of Fill Disposal Alternatives could be implemented. It is also important to note that while the proposed Bridge Alternatives may require fill for buttresses and approaches, it is assumed that due to the engineered nature of such fill, it would need to be imported from off-site, and that reuse of on-site materials would not be possible for this purpose.

Table 2-5. Summary of Excavation and Fill Quantities for Restoration Alternatives

	Restoration Alternatives (all units in cubic yards)		
	Alternative 2	Alternative 3	Alternative 4
Excavation Items			
New Main Channel			
a) Upstream of Pacific Way	2,700	2,000	2,000
b) Downstream of Pacific Way	4,400	3,200	600
c) Downstream of Footbridge	1,500	1,600	1,600
New Green Gulch tributaries	100	0	0
Backwater Channel[1]	5,000	0	0
Wetlands Excavation[2]	11,000	0	0
Lagoon Excavation(s)	0	101,100[3]	172,200
Remove Levee Road	2,500	2,500	2,500
Expand Backbeach Lagoon[4]	3,000	3,000	3,000
Remove Lower Parking Lot and Picnic Area	1000	1000	1000
Total Excavation[6]	**31,200**	**114,400**	**183,000**
Fill Items (Not including Parking Lot)			
New Creek Berms	1,800	800	400
Fill Existing Main Channel	2,000	2,500	2,500
Fill Existing Green Gulch tributaries	600	0	0
Trails & Emergency Staging Area[5]	1,400	1,400	1,400
Total Fill	**4,800**	**4,700**	**4,300**
Net Excess Material	**26,400**	**109,700**	**178,600**

Notes:

1 Includes extension of existing backwater channel and deepening the former main channel.

2 Excavation of wetland areas for Restoration Alternatives 3 and 4 are included under Lagoon Excavation.

3 Based on 30,800 and 70,300 cubic yards excavation for the west and east lagoons, respectively.

4 Includes excavation of existing tidal lagoon (approximately 200 feet by 100 ft width, 4 feet deep). Assumes that Kikuyu grass removed near the tidal lagoon will be composted and therefore is not included in earthwork balance estimates.

5 Estimated fill volume for approximately 1,200-foot long trail. Actual trail length will vary depending on the Public Access Alternative.

6 It is possible that some excavation quantities shown could be substituted for grading that would help achieve annual floodplain inundation for salmonid winter habitat.

Table 2-6. Summary of Excavation and Fill Quantities for Parking Lot Alternatives

	Cubic Yards		
Public Access Alternative	Excavation Volume	Fill Volume	Net Excess Material
A—No Action	0	0	0
B1—50 Cars at Beach	3,500	700	2,800
B2—145 Cars at Beach	0	700	(700)
B3—175 Cars at Beach	600	2,700	(2,100)
B4—175 Cars Rotated Parallel to Pacific Way	2,900	5,700	(2,800)
B5—200 Cars at Beach	0	8,600	(8,600)
C—118 Cars at Alder Grove plus 14 Spaces for Disabled and Drop-Off at Beach	3,800	7,000	(3,200)

Table 2-7. Summary of Fill Disposal Options

	Fill Disposal Site				
	Sites Analyzed in Detail in this Final EIS/EIR			Sites Analyzed Programmatically in this Final EIS/EIR	
	Unused Reservoir Pit	Upper Banducci Field	Hamilton Air Force Base Wetlands	Dias Ridge Trail	Coastal Trail South of Site
Disposal Capacity (cubic yards)	23,800	4,000	178,000	24,000~~4,000~~	4,000
Stockpile Capacity (cubic yards)	NA	8,500	NA	NA	NA
Total Capacity (cubic yards)	23,800	12,500	178,000	24,000~~4,000~~	4,000
Approximate Total Truck Trips for Full Capacity	1,800	950	13,400	1,800~~300~~	1,200
Haul Distance (miles)	0.75	0.5	20	2.5	0.75

Fill Disposal Sites Analyzed in Detail in This Final EIS/EIR

Unused Reservoir Pit

An unused reservoir on NPS property north of the site, near Hwy 1, known as the "Unused Reservoir Pit," is approximately 204 feet long, 175 feet wide, with an average depth of 15 feet, and a storage capacity of about 23,800 cubic yards of material. The pit is in a stable location on the hilltop adjacent to the portion of the Coastal Trail north of the Muir Beach overlook. Any type of soil or weedy material could be placed safely in the reservoir for disposal without concerns of sediment run-off. The surface layer would be capped with rocky material and

several inches of fine soil to promote revegetation by native shrubs, particularly coyote brush.

The reservoir was constructed by local farmer Amadeo Banducci in the late 1970s before the property was sold to NPS. It had been intended for use as a reservoir for hillside crops, but was never completed or used for that purpose.

The approximately 0.75-mile haul route to this site follows Hwy 1 north of Pacific Way, past the Muir Beach Overlook. Trucks would turn off of Hwy 1 onto the Coastal Trail to reach the reservoir. An area would be cleared near the reservoir to allow for a truck turnaround.

Upper Banducci Field

The flat field on NPS property formerly farmed by Amadeo Banducci includes an upland area dominated by non-native vegetation where vegetative material would be placed to compost. Assuming placement only in the upper portion of the field that is not wetland, and a wide buffer zone of at least 100 feet from the top of bank of Redwood Creek, the site could accommodate approximately 4,000 cubic yards of material.

In addition, the site could be used as a temporary stockpile location for material that must be removed from the project site quickly, but would not be hauled out of the watershed until a later time. With temporary stockpiles at a depth of some 5 to 6 feet, covered over winter months to prevent runoff or weed establishment, up to an additional 8,500 cubic yards of material could be accommodated at the site.

The 0.5 mile haul route to the site follows Hwy 1 north from Pacific Way to the gravel driveway adjacent to Redwood Creek and the Hwy 1 bridge. Trucks would travel down the driveway, cross an intermittent tributary that would be temporarily filled, and up the field for disposal of compost or stockpiling of fill in the upper portion of the site. The road through the field would be created by mowing a swath of vegetation; no fill would be placed other than that related to the tributary. The temporary fill in the tributary would be removed annually prior to the rainy season, and replaced in spring as needed.

Hamilton Air Force Base Wetland Restoration

USACE and the CCC are jointly conducting an extensive wetland restoration project at the former Hamilton Air Force Base in Novato, California. Due to subsidence of the former wetland, vast quantities of fill material are needed to restore the wetlands fringing San Francisco Bay. While most of the fill for the Hamilton project will be dredged material imported by barge, the project could accept large quantities of clean fill transported by truck. With the exception of weedy material, fill material of a wide range of soil textures would be acceptable for this purpose. The largest quantity of fill that could be generated by any of the three Big Lagoon project alternatives, about 191,000 cubic yards of material, could be accepted for use at the Hamilton wetland restoration project.

Potential environmental impacts or benefits of fill placement at the Hamilton wetland restoration site have been addressed by the EIS/EIR prepared for that project (Jones & Stokes 1998), and are not revisited here except for the purposes of the cumulative impact analysis. The analysis related to disposal at the Hamilton site in the current Final EIS/EIR is therefore restricted to an evaluation of hauling trips between the Big Lagoon site and Hamilton, and related environmental effects.

The approximately 20-mile haul route to this fill site follows Hwy 1 south from the site to Tam Junction in Mill Valley for approximately 7 miles, and then north on US-101 about 13 miles.

Fill Disposal Sites Analyzed Programmatically in This Final EIS/EIR

Dias Ridge Trail Recontouring

The Dias Ridge Trail is a former ranch road extending from Panoramic Highway through Tamalpais State Park lands to NPS lands to the south. The trail ends on Hwy 1 south of Muir Beach at a dangerous curve in the road where there is no road crossing or pedestrian path. The former ranch road was built on landscape contours that promote erosion. It currently has numerous gullies, thru-cuts, and head-cuts. NPS and Tamalpais State Park are currently planning a project to recontour the trail in an alignment on the landscape that will significantly reduce erosion and eliminate the erosive scars of the existing trail. Up to about 24,000~~4,000~~ cubic yards of clayey, rocky soil, such as the type of material in the levee road that will be removed, may be used to recontour the trail.

Potential environmental impacts and benefits of the trail recontouring are being addressed through separate NEPA/CEQA documentation prepared by California State Parks and NPS for the Dias Ridge Trail project, and are not discussed here except for the purposes of the cumulative impact analysis. The analysis related to disposal at the Dias Ridge site in the Final EIS/EIR is therefore restricted to an evaluation of hauling trips between the Big Lagoon site and Dias Ridge, and related environmental effects.

The 2.5-mile haul route from the Muir Beach project site to Dias Ridge follows Hwy 1 south to the intersection with Panoramic Highway (also known as “Three Corners”) and up Panoramic Highway to the turn-off onto the Dias Ridge Trail.

Coastal Trail Recontouring, South of Site

The Coastal Trail south of Muir Beach to Coyote Ridge follows a coastal route used by previous generations, but its poor alignment on hillslope contours promotes erosion. Approximately 2,500 to 4,000 cubic yards of clayey, rocky soil, such as that to be excavated for the levee road removal, could be used to recontour the trail in a sustainable alignment that would not be susceptible to continued erosion or gullying.

The haul route to this site would not require travel on public roads. Trucks would travel over the levee road or new emergency access road to the Coastal Trail intersection, then up the hill to trail recontouring locations between Muir Beach and Coyote Ridge. The total distance from the project site to Coyote Ridge is 0.74 miles.

Because the specific locations for trail recontouring have not been identified at this time, and because the Coastal Trail in this area will be the subject of a future Determination of Eligibility for listing in the National Register of Historic Places, the analysis of this site is limited and only addresses the effects of haul trips and the typical effects of trail recontouring. Should the recontouring project move forward, it would be the subject of a subsequent NEPA analysis.

Construction Scenario

As identified above, construction scenarios would be very similar under all of the restoration, Public Access and Bridge Alternatives. The following sections provide an overview that applies to all combinations of restoration and public access, with distinctions between the alternatives presented in the text.

Construction Equipment and Personnel

Construction would be completed using standard construction equipment. The main pieces of equipment to be used would likely include the following.

- Compressors/jack hammers.
- Excavators, backhoes, scrapers, water trucks, compactors.
- Front-end loaders, cranes, forklifts.
- Flat-bed delivery trucks.
- End and bottom dump trucks, ten-wheel dump trucks.
- Paving equipment.
- Concrete delivery trucks.
- Welding equipment.

The typical crew size on site at any one time would vary between 5 and 30 workers, plus supervisory personnel, inspectors, monitors, and volunteers.

Construction Footprint

Because project design has not been completed, detailed assumptions for the area disturbed by construction under each alternative are not yet available. Disturbance would include the footprint of new project features, as well as

temporary access roads, staging areas, stockpile areas, and bypass roads. Low impact methods for access roads, such as temporary placement of mats or plywood as opposed to new road grading, may be used where appropriate, although they would not be used for the Pacific Way bypass road.

Staging areas would be located in previously disturbed locations to the extent possible, including the existing parking lot and the emergency turnaround near the pedestrian bridge. The specific locations of access roads, staging areas, etc., will be identified during project design, and will be selected to minimize the potential for adverse impacts.

Construction Phasing, Schedule and Major Tasks

Detailed construction phasing will be developed as part of project design; the information presented here is intended to identify the major tasks associated with construction, as well as any constraints driving construction phasing.

Construction is anticipated to begin in about 2008 or 2009 and would take between 3 years (for Restoration Alternative 2) and 4 years (for Restoration Alternatives 3 and 4) to complete. Estimates for construction duration have assumed a normal working schedule (i.e., one 8 hour shift per day, 5 days per week). Construction would be limited to the hours between 8:00 a.m. and 5:00 p.m., Monday through Friday and 9:00 a.m. and 4:00 p.m. on Saturdays, with no construction allowed on Sundays. These estimates of construction duration would be shortened by extending the seasonal construction window.

Major construction tasks are described below; some tasks would recur each year of construction, while others would only occur once.

Pre-Implementation

Major tasks to be accomplished include plant propagation, clearing trees for construction, vegetation composting, and log acquisition for use as LWD. Geotechnical borings would be conducted in the vicinity of Pacific Way to analyze the subsurface as part of bridge design. These borings could be coordinated with further analysis of the extent of archeological resources at the site.

Site Preparation and Mobilization

Project mobilization will include setup of unpaved staging and parking areas (including clearing and grubbing), recycling of debris, installation of unpaved access and hauling roads, installation of construction interpretation and signage, equipment mobilization, installation of construction fencing and gates, installation of best management practices (BMPs) for erosion control and other aspects of resource protection, and installation of the temporary creek crossing to the Upper Banducci Field for hauling of vegetation for composting.

Parking Lot Reconfiguration

This includes removal of fill associated with the existing parking lot and picnic area, clearing and grubbing and placement of fill at the new parking lot location, and revegetation in disturbed areas and in parking lot swales.

Pacific Way Bridge Construction

This task will include construction of a temporary bypass road, including clearing and grubbing, removal of existing pavement and off-site disposal, construction of the new bridge, water line relocation, and construction of bridge approaches. After construction is complete, the temporary bypass road would be removed. It is possible that the restoration would be implemented prior to construction of the new bridge. In that scenario, the realignment of the creek in the vicinity and upstream of Pacific Way would be deferred until construction of the bridge, and a temporary channel would be constructed that connects the existing Redwood Creek channel with the downstream realigned segments.

Removal/Relocation of Utilities, Tavern Remnants, Concrete Channels, Buried Walls, and Other Features

Water, telephone and power service lines would be relocated, and existing power lines would be abandoned and removed. Power lines currently in the wetland area may be replaced with underground lines down a portion of Pacific Way, but other existing power poles along Pacific Way would remain in place. AT&T utility boxes adjacent to Pacific Way would be relocated, most likely closer to Hwy 1. Fences, gabions, tavern remnants, buried walls, and other concrete structures would be removed and disposed of.

Backbeach Lagoon Enhancement and Dune Restoration

This would include excavation to the identified depth, fill disposal, installation of LWD, and fencing of dune areas.

Creek Realignment

This will include clearing and grubbing while avoiding as many mature trees as possible, excavation of the backwater channels, main channel, tributary channels, drainage swales, and the levee road, filling of portions of abandoned channels (where applicable), LWD installation, berm construction, and revegetation.

Wetland/Lagoon Creation

This will include clearing and grubbing, excavation of the wetland/lagoon features, fill disposal, and revegetation.

Trail and Emergency Access Road Construction

This task will involve clearing, and grading, fill placement where necessary, and minor drainage improvements. A new crossing over the tributary will also be built.

Construction of Boardwalks, Interpretive Signs and Displays, Picnic Areas, Restrooms, Overlook Platforms

Features would be installed at the identified locations.

Invasive Species Removal and Revegetation

A variety of invasive species will be removed and composted off-site, either through mechanical/manual removal (e.g., Cape Ivy) or by excavation (e.g., Kikuyu grass). Revegetation will be performed using mature native vegetation and reseeding that has been propagated in advance to the maximum extent possible.

Winterization and Demobilization

Winterizing the site will include revegetation, installation of erosion control measures, removal of construction equipment as appropriate, and removal of fill from the creek leading to the Upper Banducci composting site.

Channel Commissioning

Once the new channels and other water features are complete, this task will involve flow diversion and connection with new channel, as well as fish relocation and monitoring.

Archeological, Cultural, Biological, and Other Resource Monitoring

These activities would be conducted throughout the project duration as needed.

Considerations for Construction Approach

The following considerations and constraints will drive actual construction phasing and scheduling.

Construction Season

Most construction (and particularly in channel work) would be restricted to the August 1~~15~~ –October 31 dry season. Tree removal would be conducted outside of the nesting season (after August 1st ~~15th~~). Some construction activities, such as those related to the parking lot, may be permitted to occur outside of the seasonal work window.

Coho Salmon and Steelhead Habitat

Although the dry-season timing of the construction window will prevent potential construction-related impacts to migrating Coho salmon and steelhead, construction will be phased to protect rearing juvenile Coho salmon and steelhead that may occur in the stream channels.

At present, flows in Redwood Creek are bifurcated into two channels, with the west channel being the dominant channel. For Alternatives 2 and 3, the new channel and/or small lagoons would be excavated without disturbing the existing eastern channel, leaving it intact to provide habitat for juvenile rearing. Both alternatives would require excavating a portion of the eastern channel (to connect and extend the backwater channel under Alternative 2, and the west lagoon under Alternative 3). Prior to excavation, the western channel would be physically isolated from the eastern channel and fish would be relocated. Relocation would involve a variety of methods, including herding them away from the site, and the use of nets and/or electrofishing to capture fish. Nets or cofferdams would be

used to prevent entry of fish into the project area during construction activities. Handling of these species would be overseen by a qualified biologist with appropriate handling permits.

The existing western channel, proposed for abandonment under Alternatives 3 and 4 and only partial filling under Alternative 2, would not be backfilled until flows were diverted to the new channel/lagoon system and fish were relocated. Backfilling the abandoned channel would be sequenced to minimize the potential for fish stranding or increases in turbidity

Under Alternative 4, excavation of the new large lagoon would be phased to protect rearing juvenile fish. First, the new channel and west portion of the lagoon would be constructed without disturbing the existing channel. Flows would then be diverted to the new channel/lagoon system, allowing lagoon excavation near the existing channel to be completed. At this time, fish from the existing channel would be relocated to the active lagoon. The second phase of lagoon excavation would be physically isolated from the active lagoon as long as possible. Sediment control measures such as silt curtains would be installed prior to connecting the excavation area to the active lagoon.

If construction were phased over several years, creek restoration would be sequenced to provide a through-going creek channel allowing fish up- and downstream passage during the period between construction seasons (November–August), which corresponds roughly with salmonid spawning and migration.

California Red-Legged Frog Habitat

Under Restoration Alternative 2, existing CRLF breeding habitat would not be disturbed. For other alternatives, new CRLF habitat would be established and functional prior to any work in existing habitat, and frog egg masses and tadpoles would be relocated. Excavation or other construction activities in existing aquatic habitat would also only occur between the dry season of August 1~~15~~–October 31, or at least before the onset of the rainy season, for protection of frogs and to ensure that actions are conducted outside of both breeding and tadpole rearing season.

Access along Pacific Way

Because some Muir Beach residences can only be accessed from Pacific Way, a road must be maintained open for vehicle access throughout construction. To allow construction of the new bridge, a temporary bypass road would be constructed to provide continuous vehicle access. The temporary road would be located south of Pacific Way and would remain active until the new bridge is completed. This bypass is expected to rejoin Pacific Way immediately east of the existing Pacific Way Bridge. To maintain vehicle access during removal of the existing bridge, the existing channel would need to be partially filled to serve as a temporary roadway. Therefore, the existing bridge would not be removed until the new bridge is finished and flows have been diverted to the new channel. If the construction footprint of the new bridge precludes this approach, another method of crossing the existing Redwood Creek channel would be used, such as laying

down a temporary clear-span bridge or installing a temporary culverted crossing and associated fill.

In addition, the pavement associated with the bypass road would not be removed until the new channel is ready to be commissioned, so that it provides a grade control to protect against channel avulsion while the project is still in construction and the existing creek channel remains in use.

Visitor Parking

Visitor parking at Muir Beach during construction would be maintained to the maximum extent possible. Portions of the parking lot may be used for staging areas, and so would result in reduced parking capacity. In addition, during construction of the new parking lot, as well as during other phases of construction to be determined, the parking lot may be closed entirely. Appropriate signage would be placed at the intersection of Hwy 1 and Pacific Way and other locations notifying visitors of the conditions at the parking lot. Construction activities would be minimized on the weekends to reduce effects on visitors, and the parking lot would be constructed in the off-peak or shoulder season when park visitation is less, if possible.

Removal of Levee Road

Currently, the levee-top road serves as the emergency access route to the beach, so the new emergency access road along the site perimeter would be constructed before removing the existing levee road. In addition, the levee road now forms a physical barrier between Redwood Creek and Green Gulch pasture. Maintaining the road in place as long as possible would isolate the creek from the construction zone, offering an interim measure to protect fish during excavation in Green Gulch pasture.

Dewatering

Dewatering of the creek channel would be conducted when construction activities are conducted in the active channel to reduce downstream sediment loads. Cofferdams and a pumped bypass would be used to dewater the construction zone, and a bypass pipe would pump flows to the downstream reaches. Because dewatering is anticipated to occur during low-flow conditions, the bypass pipe would be several inches in diameter and would be screened to avoid potential for entrainment. Salmonids in any areas to be affected would be relocated prior to dewatering, following requirements from regulatory agencies, using methods as described above. Dewatering that could affect CRLF habitat would not be conducted during breeding season. Regulatory agencies may require specific water quality for discharge of dewatering effluent. One alternative to dewatering would be the use of land-based dredging equipment (such as a hydraulic excavator or drag line) for excavation.

Excavation Production Rates

Excavation production rates were estimated to help approximate the number of years needed to create the small and large lagoons. The maximum feasible production rate for excavation and truck loading is assumed to be roughly 500 cubic yards per day. This rate is low compared to many typical construction

projects due primarily to limited areas for truck access and turn-around during excavation. Using this maximum rate, as much as 60,000 cubic yards of excavated material could be removed in a 6-month construction season. Note that the actual production rate may be less than the presumed maximum rate, given permit requirements, traffic restrictions, and other implementation conditions.

Communication Strategy

Outreach and public education about park resources is an important part of the NPS mission, and NPS intends to keep the public fully informed and up to date as planning and construction of the proposed project move forward. To that end, NPS will post regular project updates on the NPS/GGNRA web site, in hard copy at GGNRA and other area facilities, and will host public meetings at key project milestones. The project updates and meetings will be designed to help the public understand and feel connected to the project. They will explain the need for restoration and public access modifications, discuss the planned construction, provide progress reports on construction and site recovery, describe what the public can expect to see/experience at Muir Beach throughout the process, and share the vision for long-term outcomes. They will also provide contact information for NPS staff who can respond to public questions, concerns, and comments.

A key goal of the public outreach will be to reduce the effects of disruption to recreational uses at Muir Beach, by allowing visitors to choose another facility if they feel their experience at Muir Beach would be unduly compromised by construction or changing site conditions. To address potential visitor concerns, NPS will ensure that web site postings include information on parking reduction or closure, trail closures, areas affected by construction noise, and other construction- and site recovery–related issues. Notices with construction information will also be posted at Muir Beach, and at other National Parks facilities, including but not limited to the Muir Woods National Monument Visitor Center and bulletin boards, the Point Reyes National Seashore Visitor Center and bulletin boards, and the Presidio; project information will be available at <http://www.nps.gov/goga>. Construction information notices will describe the location, nature, and anticipated duration of proposed construction, and will identify the anticipated nature and duration of any closures or other changes in recreation availability at Muir Beach. Construction information notices will also identify other area facilities offering similar uses, and will include a contact name, phone number, and e-mail address for questions and concerns. Construction information notices (including information on potential closures and changes in availability) will be posted at least a month prior to construction each year, and will remain in place throughout the construction season.

Ongoing Maintenance and Management

For the purposes of the analysis, ongoing maintenance and management activities associated with this project are limited to those activities that Marin County and NPS would not undertake in absence of the project, or that are not already part of standard operating procedures (such as maintenance of roadways, restrooms, etc.).

Dredging and other maintenance of the physical characteristics of the site are not considered to be part of the project since the Restoration Alternatives are assumed to be self-sustaining without intervention through the 50-year life of the project. Unexpected future conditions could result in the need for channel dredging or other maintenance activities, which would need to be addressed through additional CEQA/NEPA documentation.

Ongoing maintenance activities under the proposed project would include the following.

- Ongoing invasive species removal.
- Maintenance of the emergency access road.
- Maintenance of plantings.
- Mosquito abatement where necessary.
- Management of fencing on the beach and at other locations in the project site to protect dune vegetation and creek habitat.

Civic Engagement in Park Stewardship

The energy and commitment of volunteers, who are often willing to engage in park care projects because they care deeply about their “back yard” park resources, represents a tremendous resource for park stewardship. Recognizing the value of this resource, NPS is developing a range of public involvement opportunities for the proposed project. Volunteer programs will be designed so that they also meet NPS’s educational responsibility, providing the public with opportunities to learn about park resources and the ecosystems they represent.

Details will be finalized as project design moves forward, but at the present time, opportunities for volunteer involvement during construction are expected to include activities such as removal of invasive non-native vegetation, native vegetation planting, and short-term planting maintenance and weeding. Following restoration construction—during site recovery and once the site has matured—volunteers will likely continue to be engaged in weeding and other aspects of planting maintenance. During site recovery in particular, volunteers may also be trained as docents to help visitors understand the long-term changes occurring on the site.

Alternatives Eliminated from Further Study

The following sections briefly describe the Restoration, Public Access and Fill Disposal alternatives that were considered but have been eliminated from detailed analysis in this Final EIS/EIR. The reasons for their elimination from further analysis are also summarized. Reasons for dismissal include technical and economic factors, inability to achieve the project purpose and need, conflicts with local or regional planning documents or requirements, and environmental factors.

Throughout the planning process, a large number of alternatives have been suggested, including numerous variants of the alternatives analyzed in this Final EIS/EIR. Thus, the following discussion is not intended to be comprehensive, but rather to provide an overview of major alternatives and the reasons why they were not considered reasonable or feasible as approaches to the proposed project. Future implementation of many of these alternatives would not be precluded by implementation of the alternatives considered in the Final EIS/EIR.

Restoration Alternatives

The following Restoration Alternatives were eliminated from Final EIS/EIR analysis.

- **Watershed Restoration to Control Sediment Input.** Restoration actions in the Redwood Creek watershed upstream of the project site have been suggested as a means of reducing sediment input to the site and addressing the source of impairment. These alternatives were eliminated from Final EIS/EIR analysis because they exceed the scope of this project. However, numerous actions have been and will continue to be undertaken through separate projects to reduce sediment loads, increase appropriate sediment trapping in the upper watershed, and refine our understanding of sediment sources.
- **Minimum Action Alternative.** A “minimum action alternative” was considered suggested which would be similar to Alternative 2 because it would entail removal of the levee road and the lower parking lot, and construction of a new Pacific Way Bridge. However, it would allow the channel to naturally relocate, or avulse, to a new location without construction of a new channel alignment. This alternative was eliminated because of the increased possibility for development of an undefined or braided stream channel with shallow water that could impair fish passage. The potential for such a condition, called the “Swampy Meadow” scenario, and its effects on fish passage, are discussed in detail in the Addendum to the Feasibility Analysis Report (Philip Williams & Associates 2004).

  There is a high degree of uncertainty as to whether or not Redwood Creek would establish a new channel in the event of a channel avulsion into Green Gulch Meadow, or whether a swampy meadow would persist. The low

gradient of the floodplain and high sediment yield makes it most likely that a channel would not become established, at least within a short to medium timescale.

If this minimum action alternative led to a swampy meadow, fish passage would be more difficult than at present. In most years there would probably be sufficient depth for adult in-migration, but there would be fewer "passable" events per season than at present. There is insufficient data and model precision to evaluate conditions for outmigration of juveniles, but it would again be harder than present.

- **Reintroduction of Extirpated Species.** Reintroduction of species—such as tidewater goby and freshwater shrimp—that are believed to have been historically present in the Big Lagoon system was not considered because it would not fulfill the purpose of the project. However, implementation of the Restoration Alternatives analyzed in this Final EIS/EIR is not expected to preclude future reintroduction of appropriate native species.

Public Access Alternatives

The following Public Access Alternatives were eliminated from Final EIS/EIR analysis.

- **Dual Parking Lots.** Provision of two parking lots, such as one at the Alder Grove and one in the general vicinity of the existing parking lot, was not considered due to the potential for increased traffic congestion as drivers circulate between lots looking for parking places.
- **Shrinking Parking Lots.** Parking lots that would be designed to shrink as public transit use rises were not considered because demand for personal vehicle parking is expected to remain at current levels or increase, regardless of increased public transit opportunities. <u>However, if public transit opportunities become available and parking demand declines after project implementation, NPS could take separate actions at that time to reduce the size of the parking lot.</u>
- **Remote Parking Lot.** Construction of a remote parking lot, such as one at the Old Ballfield, at the intersection of Hwy 1 and Muir Woods Road, would create public safety hazards as pedestrians attempt to cross Hwy 1, and would impair public access to the popular site to a significant degree, which is inconsistent with NPS goals for the site.
- **Alternative Transportation.** Limited public transit access is already provided to the site. Planning and provision of more accessible and visitor-friendly public transportation into the future is beyond the scope of this project. New modes of public transportation to this and nearby recreational sites were considered through the CTMP project in 2003 and 2004, but the CTMP project is no longer engaged in active planning. However, Marin County is currently working with Caltrans to plan a transit stop at the intersection of Hwy 1 and Pacific Way.

- **Separate Access Road.** Provision of a separate access road adjacent to Pacific Way for Muir Beach visitors was not considered further due to the potential for additional environmental impacts associated with construction and use of such a road. Construction of an additional road would likely result in a net loss of wetland acreage under the terms of the Corps.
- **Street-Side Parking.** Providing street-side parking along Pacific Way or Hwy 1 is not being considered because it would increase the footprint of the roadways, with potential for additional environmental impacts associated with construction and use of such parking. It would also raise safety and traffic congestion issues along these roadways as vehicles are parking and visitors wait for parking spaces to open.
- **Parking Lot on Green Gulch Property.** A parking lot on Green Gulch property is not proposed because the San Francisco Zen Center Board of Directors, as property owner, opposed use of their land for this purpose.

Bridge Alternatives

The following Bridge Alternatives were eliminated from Final EIS/EIR analysis.

- **Alternative Bridge Configurations.** While a variety of bridge configurations were evaluated in Appendix D, only a subset were subjected to analysis in the Final EIS/EIR since they captured the reasonable range of possible bridge configurations and potential impacts.
- **Alternative Access.** At present, Pacific Way is a dead-end street. Possibilities for connecting Pacific Way with other surface streets was considered, as it would eliminate the need for all-weather access at the bridge. However, no feasible locations for such a roadway connection were identified.

Fill Disposal Alternatives

Several alternatives for fill disposal were proposed and rejected, as follows.

- **Barging and Deep Offshore Disposal.** This alternative was not considered further because it was the most costly and logistically difficult alternative, involving saturating excavated material to make a slurry, pumping to a barge, and transporting the material several miles offshore for deep ocean disposal.
- **Pumping and Shallow Offshore Disposal.** This alternative was not considered further as it would not be allowed within the Gulf of the Farallones National Marine Sanctuary.
- **Landfill Disposal.** Landfill disposal was not considered further due to the presence of other cheaper options for fill disposal which would still result in beneficial reuse of the fill material.

- **Reuse at Santos Meadows.** This site is owned by California State Parks, which does not support use of the site for fill disposal.
- **Disposal at Lower Banducci Field.** This site was not considered further due to technical infeasibility of placing fill within an active floodplain.
- **Stockpiling or Reuse at Former Ball Field.** This site was not considered further due to technical infeasibility of placing fill in a historic floodplain that is proposed by NPS to be restored as an active floodplain.
- **Stockpiling and/or Disposal at Green Gulch Farm.** This site was not considered further because possible fill placement locations are jurisdictional wetlands regulated by USACE.

Preferred Alternative

The preferred alternative~~s~~ consists of Restoration Alternative 2 (Creek Restoration), Public Access Alternative B4~~B3~~ (a 175-car parking lot at the beach rotated parallel to Pacific Way), Bridge Alternative BR4~~BR3~~ (a 250~~150~~ foot–long bridge with a raised road at each end), disposal of fill materials at the Unused Reservoir Pit, and composting of appropriate materials on NPS property at the Upper Banducci Field. Some suitable fill material may also be used for the Dias Ridge recontouring, or possible Coastal Trail recontouring, if it is available, but all material would be used or safely deposited within the watershed. This alternative is shown in Figure 2-24. It should be noted that between circulation of the Draft EIS/EIR and publication of the Final EIS/EIR, the preferred Public Access and Bridge Alternatives have been changed from B3 to B4, and BR3 to BR4, respectively. Public Access Alternative B4 and Bridge Alternative BR4 are now preferred for their superior benefits related to long-term hydraulic and sediment transport processes, which have been determined to be more beneficial to the long-term protection of habitats at the site. These are minor technical changes that, pursuant to State CEQA Guidelines section 15088.5, “Recirculation of an EIR Prior to Certification,” do not require recirculation of the Draft EIS/EIR. This combination of project features (Restoration Alternative 2, Public Access Alternative B4, and Bridge Alternative BR4) is most consistent with the NPS mission, offers the best combination of project benefits, including factors related to both the project’s purpose and need and its impacts, as follows:

- It will restore a functional, self-sustaining ecosystem to the maximum extent of any of the alternatives.
- It will support sustainable populations of existing special status species.
- It will ensure improved vehicle access for the Muir Beach community.
- It will provide a visitor experience that is compatible with ecosystem restoration and historic preservation.
- It will have a relatively small construction footprint, relatively short construction duration, and will minimize construction-related impacts such as dust, noise, and the need to haul and dispose of fill.

- ~~It will be less costly than other alternatives considered which could have marginally greater environmental benefits.~~

The project would be completed consistent with NPS and Marin County regulations and requirements.

Identifying~~Selection of~~ the Preferred Alternative

As required by NPS policy, a Value Analysis process was used to inform the selection of the preferred alternatives. The Value Analysis process identifies project-specific evaluation factors based on project goals and the NPS mission. It then identifies and ranks the relative advantages of each of the alternatives in meeting the evaluation factors. When completed, the results show which alternative provides the greatest benefit to meet project goals and the NPS mission. Evaluators do not consider costs to compare advantages, but they are used to develop a cost-benefit ratio. The cost-benefit ratio shows whether substantially added costs provide substantially added benefits. A more expensive alternative may be shown to be more advantageous if its substantially added costs produce substantially added benefits. Costs are also used to refine alternatives to either increase benefits or reduce costs that do not produce benefits.

Separate Value Analysis evaluations were used to evaluate the Restoration Alternatives, the Public Access Alternatives, and the Bridge Alternatives. A neutral, experienced facilitator guided each of the three Value Analysis processes. Each set of alternatives was evaluated for specific objectives within the categories of natural resource protection, cultural resource protection, public and worker health and safety, visitor enjoyment, operational efficiency, and minimization of construction impacts.

Based on the benefits comparison for all categories combined, Restoration Alternative 2 had the highest ranking of overall advantages. Project goals can be met through Alternative 2, with substantial improvements in natural channel function, habitat quality, and flood reduction. The Value Analysis method of comparing costs of alternatives showed that although Alternatives 3 and 4 had added habitat and flood reduction benefits, their substantially higher costs—due primarily to the much greater quantities of fill that would have to be excavated and hauled down Hwy 1—would not bring substantially greater value to the project. Alternative 2 therefore had the highest cost benefit ratio. The primary restoration costs, not including all construction tasks, would be approximately $4 million for Restoration Alternative 2 versus $10 million for Restoration Alternative 3 and $16 million for Restoration Alternative 4.

Based on the benefits comparison, the two Public Access Alternatives that retained the same capacity as the existing parking lot (B3 and B4) were ranked as having the most benefits because they would not affect parking capacity and therefore had the least traffic impacts, while minimizing creek functioning. NPS initially selected Public Access Alternative B3, a 175-car lot that shortens the

existing parking lot more than the minimum removal of the lower 90 feet and builds into a portion of the adjacent riparian area, as the preferred alternative in the Draft EIS/EIR. Although Alternative B3 is smaller than Alternative B4 (resulting in less impact on wetlands and mature riparian areas), it is particularly important to NPS that the new parking lot avoid impacts on the creek and upstream flooding. The preferred Public Access Alternative therefore has been changed from B3 to B4 in this Final EIS/EIR for its superior geophysical and long-term ecological benefits related to improved flood protection through the lowest portion of the reach and improved sediment transport to the beach and nearshore environment. As previously stated, this is a minor technical change that, pursuant to State CEQA Guidelines section 15088.5, does not require recirculation of the Draft EIS/EIR prior to its certification. ~~The two public access alternatives that retained the same capacity as the existing parking lot were ranked as having the most benefits since traffic impacts would not be worsened by either shrinking or expanding the capacity, although Alternative B4 was ranked with slightly higher advantages than B3. It was particularly important to NPS that the new parking lot avoids impacts to the creek and upstream flooding, which can be fully achieved through Alternative B3 without rotating the parking lot as in Alternative B4, although Alternative B4 had slightly higher advantages with expanding flow connectivity. Compared to Alternative B4, Alternative B3 had the added advantage of retaining more of the mature riparian area and avoiding loss of wetlands in the parking lot footprint because its total size is about the same as the existing lot and smaller than that of Alternative B4. Alternative B3 also had a higher cost-benefit ratio, because much less fill would need to be moved for B3 than for B4 to achieve similar benefits.~~

The initial Value Analysis ~~benefits comparison~~ showed that Bridge Alternative BR4, the longest possible bridge, had slightly higher benefits than Bridge Alternatives BR3 and BR2, which were equally ranked, and Bridge Alternative BR1 had almost no benefits since it would obstruct flood flows. Marin County initially selected Bridge Alternative BR3 as the preferred alternative, but the preferred Bridge Alternative has been changed from BR3 to BR4 in this Final EIS/EIR. This change is based on an understanding that the longer bridge will provide substantially greater benefits than BR3 for both floodplain function and vehicular access. The longer bridge would accommodate greater flows and minimize potential obstructive effects on backwater flows that could increase flood elevations upstream. Bridge Alternative B4 has also been shortened from 266–300 feet to 250 feet because the shorter length is a more realistic design length, when existing constraints on Pacific Way are taken into account more fully. Its maximum width has been narrowed from 36 feet to a maximum possible width of 32 feet. Again, changing the preferred Bridge Alternative from BR3 to BR4 is a minor technical change that, pursuant to State CEQA Guidelines section 15088.5, does not require recirculation of the Draft EIS/EIR prior to its certification.

Costs for the bridge alternatives presented in the Draft EIS/EIR were slightly underestimated for some alternatives and overestimated for others. Some assumptions related to bridge costs have been refined for the FEIS. The original costs, and the revised costs based on conceptual designs are: Bridge Alternative

BR4, $4.3 million in the DEIS/EIR, now estimated at 4.4 million; BR3, $3 million in the DEIS/EIR, now estimated at $3.5 million; BR2, $2 million in the DEIS/EIR, now estimated at $1.5 million; and BR1, estimated at $2.1 million in the DEIS/EIR and now estimated at $2.1 million. The County has selected the longer Bridge Alternative (BR4) despite its higher cost than BR3 because of its substantially greater benefits for both creek and floodplain function and access for residents during flood events. The BR4 alternative also is expected to require the least maintenance. ~~Evaluators found that Bridge Alternative BR4's benefits were only slightly greater than other alternatives, but its costs were substantially greater, meaning that added costs did not bring substantially added benefits. Bridge Alternative BR4 had an estimated cost of $4.3 million compared to $3 million for Bridge Alternative BR3 and $2 million for Bridge Alternative BR2. Bridge Alternative BR2 and Bridge Alternative BR3 each accommodate natural processes and flood flows through different means, with the short bridge of BR2 allowing flood flows to pass over the road and the longer bridge of BR3 allowing high flows on the floodplain to pass under bridge. Based on this important difference, Bridge Alternative BR3 was selected as the preferred alternative, despite its higher cost than Bridge Alternative BR2, because BR3 provides both greater natural resource benefits and better vehicular passage than BR2,~~

Benefits of the Preferred Alternative

The combined benefits of the preferred alternatives selected for this project, the Restoration, Public Access, and Bridge Alternatives, will bring to life a long-term vision for restoring ecological integrity to the mouth of one of the San Francisco Bay Area's most treasured and natural watersheds. Redwood Creek flows from Mount Tamalpais to the coast in a largely protected watershed, but it is at its most confined, dysfunctional, and fragmented condition at the project site. When this project is implemented, the dynamic interaction of natural processes will once again return to virtually the full landscape for the first time in almost 100 years. Modern anthropogenic influences on this scenic Marin County coastal lowland will not be fully erased, but the project will still enable the forces of a natural stream to retake their place as the centerpiece of the landscape.

The combined set of preferred alternatives will allow a natural and dynamic evolution of the creek, floodplain and wetland system; remove as many obstacles as reasonably possible to natural processes; minimize the need for maintenance; and reconcile conflicts with desirable human activities to the extent possible. Water, waves, and wind will create landforms, aquatic niches, and naturally sustained habitat without undue human interference or landscape relicts.

While benefits and impacts of the Restoration, Public Access, and Bridge Alternatives are analyzed separately in this Final EIS/EIR, the greatest benefits will occur due to the combination of these three project components. Each component addresses a particular obstruction to natural creek processes that have contributed to a downward trajectory in salmonid habitat quality and increased flooding. The combined benefit of creek realignment under Restoration Alternative 2, parking lot reconfiguration under Public Access Alternative ~~B3~~B4

(previously Public Access Alternative B3), and Pacific Way Bridge Alternative ~~BR3~~ BR4 (previously Bridge Alternative BR4) will create the most unobstructed creek and floodplain in the project area since about the 1920s. All of the components function together to improve flow conveyance, sediment transport, floodplain function and habitat value, while also improving vehicular access and maintaining visitor and residential access. Sediment will be transported more effectively because the creek channel will be relocated to its natural topographic low point and will slope at a more natural gradient, and there will no longer be obstructions from an undersized floodplain next to the parking lot or an undersized Pacific Way Bridge. The preferred parking lot alternative will expand adjacent floodplain from its current 50 feet of width to a minimum of ~~180~~approximately 350 feet of width, and there would be unobstructed floodplain on the opposite side of the creek.

The project will provide the benefits that are most needed by resident coho salmon and steelhead. Essential habitat qualities needed by salmonids during winter flow conditions will be enhanced. When the creek is reconnected with contiguous floodplain habitat throughout the entire 38-acre project site, salmon using the essential floodplain habitat will no longer be obstructed from returning to the creek by a levee or a road. The floodplain will meet one of the most important winter-time needs of juvenile coho—a good feeding ground for fattening up before migrating to the ocean, thereby enhancing their chances of survival and return. New backwater habitat both upstream and downstream of Pacific Way, together with the expanded floodplain connection, will also provide steelhead and coho with areas where they can take refuge during the force of high velocity flows, a habitat quality that is currently deficient in Redwood Creek. With these improvements, the survival of young steelhead and coho over winter months is expected to improve.

The new, longer Pacific Way Bridge proposed as part of this project offers an ecological benefit that has rarely been used in typical road engineering. It will not only improve vehicular access during the winter, but it will be long enough to also span an additional ~~115~~ 215 feet of floodplain width, thereby retaining the important upstream-downstream floodplain connection for both fish habitat and natural creek meander. Whereas residents currently experience restricted road access under routine winter events, the new bridge and raised road will allow vehicular access in all but very large storm events, and even then, access will only be limited for a short duration. Although this project cannot prevent flooding in a natural floodplain, road access will be available even if there are long-term changes in flood elevations since both the road and the bridge will be higher and designed to allow for long-term channel changes. With good road access to residences during winter events, the current demand for creek dredging to reduce flooding will subside.

Visitors will experience the benefits of this project through the opportunity to witness the restoration process, which takes on new meaning as the public awareness of human interference on ecological functions grows. People seek out national parks across the United States to restore their personal sense of aliveness in places where nature unquestionably thrives. This wetland and creek restoration

at Big Lagoon would allow the estimated ~~440,000~~260,000 annual visitors to the site to share the experience of witnessing an ecosystem regaining its natural function. Even in the project's infancy after construction, when trees are immature and native wetland species have not yet colonized their likely niches, NPS expects that visitors will appreciate and enjoy the new integrity of the site as a whole, with the reconfigured parking lot acting as a less imposing central feature of the coastal landscape. Stewardship volunteers will reap a personalized enjoyment from their hands-on participation in revegetating native plant communities after construction. Visitor facilities will also be enhanced, with the parking lot blending more pleasantly with its surroundings through vegetated wetland swales, installation of new vault toilets, and, in particular, through a new trail from Hwy 1 to the parking lot. The trail will meet ADA standards, and it will provide pedestrians with an access route to the beach where conflicts with vehicles can be avoided. The trail will join a new trail alignment up Dias Ridge, making a trail available from Panoramic Highway to the beach for the first time.

The benefits of removing the channel confinements are expected to extend all the way downstream to the intermittent tidal lagoon at the north end of the beach, which will be able to scour more effectively with the improved force of winter flows from upstream. This will allow the intermittent tidal lagoon to incorporate more natural variability in its areal extent and depth. With added log structures, reminiscent of the natural large debris that would have washed downstream to the beach in the period before watershed development, the coho and steelhead will have improved cover in the intermittent lagoon.

One of the least-seen beneficiaries of this project may be the CRLF, a federally threatened species whose numbers at the site are so low that their very persistence there is in jeopardy. Because its current habitat is provided by the same features that obstruct creek processes and promote ponding, this project takes the long view toward providing a more hydrologically sustainable habitat for the frog. This project will remove the channel confinements, but will retain the cattail habitat at the south end of the Green Gulch pasture. It will also excavate new ponds that will be fed by groundwater and will support emergent vegetation where frogs lay their eggs. Should augmentation of the existing red-legged frog population be required, the improved habitat conditions should support any added frogs. With these changes and with an additional new breeding population on NPS lands at the Banducci site (0.5 mile upstream) as part of separate actions, CRLF population within the Redwood Creek watershed will be sustainable for the long-term.

The benefits of this project extend well below ground to the buried archaeological resources at the site. It is the mission of NPS to protect cultural resources, and this project will succeed in not only protecting them, but in learning more about them than had this project never been conducted. Coast Miwok who once lived in this region have left good evidence of their hunting and fishing activities at Muir Beach. As part of the project planning, NPS has conducted explorations of the subsurface shellmounds to learn more about the dates and types of Coast Miwok use. New information about the Coast Miwok activities here will be used in a new cultural resource interpretation of the site

that will add depth to the public understanding of earlier human use as well as earlier landscapes.

Beyond enhanced protection and interpretation of archeological sites, the project will also help re-establish the connection of a living indigenous tribe, the Federated Indians of Graton Rancheria, with parts of our parklands. An ecological restoration that includes a cultural-ecological component derived from the traditions and land uses of indigenous people will create a visible and tangible fabric with deep interpretive potential to visitors and respect to the original occupants of these lands.

One of the benefits of the project approach is that the ecological, flood reduction, and visitor enhancements can be achieved without having to haul truckloads of excavated fill long distances down Hwy 1 or through the commercial area of Mill Valley. The project alternatives can be constructed with all fill either reused in the local watershed or placed safely and sustainably in the Unused Reservoir Pit on NPS property.

Environmentally Preferable Alternative

NEPA requires identification of the environmentally preferable alternative. Director's Order 12 references Section 101(b) of NEPA as the criteria to be used to determine the environmentally preferred alternative. Section 101(b) states that environmentally preferred alternative is one that:

- fulfills the responsibilities of each generation as trustee of the environment for succeeding generations;
- assures for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
- attains the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;
- preserves important historic, cultural and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice;
- achieves a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and
- enhances the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Director's Order 12 interprets this to mean the alternative that causes the least damage to biological and physical environment; or best protects (i.e., preserves or enhances) cultural and natural resources.

CEQA similarly requires identification of the environmentally superior alternative. For the purposes of this document, the term "environmentally preferable alternative" is used in place of "environmentally superior alternative."

The environmentally superior alternative is Restoration Alternative 2, Public Access Alternative ~~B3~~B4, Bridge Alternative BR4, and the Unused Reservoir Pit. Each is discussed in more detail below in Table 2-8, which provides a comparison of the beneficial and adverse effects of the alternatives that were analyzed.

Restoration Alternatives

Restoration Alternative 2 is considered the environmentally preferable Restoration Alternative. This is due to the fact that it achieves similar long-term benefits with respect to ecological value and visitor/resident experience; however, construction would have a smaller footprint, would be of shorter duration than either Restoration Alternatives 3 or 4, and would require less haulage of fill off-site. This would result in reduced impacts related to:

- the physical environment in terms of air quality (fewer construction-related dust and exhaust emissions);
- biological resources in terms of disturbance to on-site vegetation and wildlife communities;
- cultural resources in terms of potential disturbance of previously undiscovered cultural resources; and
- social resources in terms of reduced effects on recreation and visitor/resident experience during construction, including effects related to construction-related vehicle trips, aesthetics, and noise.

While this alternative would not reduce flooding to the same extent as the other alternatives, the benefits identified above related to construction are determined to outweigh this shortcoming. Neither Alternative 3 nor 4 were identified as the environmentally preferable alternative because their added ecological benefits would not exceed the consequent construction impacts, particularly related to the number of truck trips on Hwy 1 and through Mill Valley to remove excavated materials. Even after substantial excavation, each of these alternatives would be subject to considerable in-filling within 50 years.

Public Access Alternatives

Public Access Alternative B4 is considered the environmentally preferable Public Access Alternative, because of its superior geophysical and long-term ecological benefits related to improved hydraulic capacity under large storm events, improved sediment transport to the beach and nearshore environment, and improved flood protection. It also does not have the same potential for reduced

Table 2-8. Alternatives Comparison Summary

Alternative	Important Features	Beneficial Effects	Adverse Effects	Conclusions Regarding Resource Impairment
Restoration Alternatives				
Alternative 1—No Action	• Ongoing maintenance dredging only as permitted for flood reduction	Minimizes construction-related effects of the action alternatives by restricting effects to periodic maintenance dredging.	Allows for continued flooding of Pacific Way, including issues related to emergency access and potential for channel avulsion and related damage to infrastructure and potential effects to fish passage and stranding. Periodic short-term impacts related to maintenance dredging, including water quality, noise, and aesthetics. Potential impacts to California red-legged frog due to need for annual management intervention to maintain breeding habitat.	Impairment is not likely, however a significant impact could occur due to channel avulsion. Avulsion would create the potential for loss of existing park resources or take of listed fish species due to inadequate conditions related to fish passage.
Alternative 2—Creek Restoration	• Realign Redwood Creek and create backwater channels and marsh • Remove Levee, Shorten Parking Lot by 90 feet • Dune and tidal lagoon restoration • Interim flood reduction measures	Reduces potential for channel avulsion and potential impacts to fish passage, and improves natural functioning of site. Provides winter and summer refugia for salmonids. Reduces flood levels. Improves dune habitat and tidal lagoon function. Reduces some invasive plant populations, and increases the extent of riparian habitat, with corollary benefits to bird species. Improves aesthetics and visitor experience through restoration of site.	Construction-related impacts from interim flood reduction actions and during the 3-year restoration project, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife. Potential impacts to California red-legged frog from construction. Reduced extent of emergent wetland habitat.	Impairment is not likely to occur. Potential for impairment due to effects on California red-legged frog would be avoided through avoiding existing aquatic habitat, proper construction practices and creation of new on-site and off-site habitat.
Alternative 3—Creek and Small Lagoon Restoration	• Realign Redwood Creek and create two open-water lagoons • Remove Levee, Shorten Parking Lot by 90 feet • Dune and tidal lagoon restoration • Interim flood reduction measures	Reduces potential for channel avulsion and potential impacts to fish passage and stranding, and improves natural functioning of site. Provides winter and summer refugia for salmonids. Reduces flood levels. Improves dune habitat and tidal lagoon function. Reduces some invasive plant populations, and increases the extent of open water and riparian habitats, with corollary benefits to bird species. Improves aesthetics and visitor	Construction-related impacts from interim flood reduction actions and during the 4-year restoration project, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife. Large construction footprint. Requires approximately 5,000-10,000 fill haul trips, many of which would proceed over a long haul distance to Hamilton AFB Wetlands. Reduced	Impairment is not likely to occur. Potential for impairment due to effects on California red-legged frog would be avoided through proper construction practices and creation of new on-site and off-site habitat.

Table 2-8. Continued

Alternative	Important Features	Beneficial Effects	Adverse Effects	Conclusions Regarding Resource Impairment
		experience through restoration of site. Restores some of the benefits of the pre-Euroamerican lagoon to the site, and allows for sediment storage in lagoons over time.	extent of emergent wetland habitat. Potential impacts to California red-legged frog from construction and relocation, as well as due to salinity effects and predation in brackish lagoons.	
Alternative 4—Large Lagoon Restoration	• Realign Redwood Creek and create one large open-water lagoon • Remove Levee, Shorten Parking Lot by 90 feet • Dune and tidal lagoon restoration • Interim flood reduction measures	Reduces potential for channel avulsion and potential impacts to fish passage and stranding to the greatest extent, and improves natural functioning of site. Provides winter and summer refugia for salmonids. Reduces flood levels to the greatest extent. Improves dune habitat and tidal lagoon function. Reduces some invasive plant populations, and greatly increases the extent of open water habitat. Improves aesthetics and visitor experience through restoration of site. Restores benefits of the pre-Euroamerican lagoon to the site, and allows for sediment storage in lagoon over time.	Construction-related impacts over 4 years including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife. Largest construction footprint. Requires approximately 8,750-17,500 fill haul trips, many of which would proceed over a long haul distance to Hamilton AFB Wetlands. Reduced extent of emergent wetland habitat. Potential impacts to California red-legged frog from construction and relocation, as well as due to salinity effects and predation in brackish lagoon.	Impairment is not likely to occur. Potential for impairment due to effects on California red-legged frog would be avoided through proper construction practices and creation of new on-site and off-site habitat.
Public Access Alternatives				
Alternative A	• No Action—175 car parking lot is not modified	Eliminates construction-related effects of the action alternatives.	Continues to restrict flood flows and natural channel function by not removing lower 90 feet of lot. Does not provide the benefits associated with the action alternatives of the new pedestrian trail from Hwy 1 to the beach.	Impairment is not likely to occur.

Table 2-8. Continued

Alternative	Important Features	Beneficial Effects	Adverse Effects	Conclusions Regarding Resource Impairment
Alternative B1	• 50 cars at beach • Pedestrian path on Pacific Way Bridge and at edge of road	Smallest footprint of any alternative, with benefits to aesthetics, habitat and floodplain function. Water quality and habitat benefits from vegetated swales between parking rows. Improves aesthetics and rustic character of site. Provides improved safety by constructing grade-separated pedestrian path.	Substantial parking shortfalls, including inadequate parking during all weekends and on weekdays during the peak season. Cascading effects on residents, visitors and visitor experience. Construction-related impacts, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife.	Impairment is not likely to occur.
Alternative B2	• 145 cars at beach in footprint of existing parking lot • Pedestrian path on Pacific Way Bridge and at edge of road	Similar footprint to existing conditions. Water quality and habitat benefits from vegetated swales between parking rows. Provides improved safety by constructing grade-separated pedestrian path.	Substantial parking shortfalls, including inadequate parking during on weekends during the peak and shoulder seasons, and on weekdays during the peak season. Cascading effects on residents, visitors and visitor experience. Construction-related impacts, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife.	Impairment is not likely to occur.
Alternative B3	• 175 cars at beach and removal of the lower end of parking lot, plus expansion into adjacent riparian area • Pedestrian path on Pacific Way Bridge and at edge of road	Provides similar parking capacity as existing conditions, with shortfalls only experienced on weekends during the peak season. Water quality and habitat benefits from vegetated swales between parking rows. Provides improved safety by constructing grade-separated pedestrian path.	Small disturbance to existing riparian forest. Construction-related impacts, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife.	Impairment is not likely to occur.

Table 2-8. Continued

Alternative	Important Features	Beneficial Effects	Adverse Effects	Conclusions Regarding Resource Impairment
Alternative B4	• 175 cars at beach • Parking lot rotated parallel to Pacific Way • Pedestrian path on Pacific Way Bridge and at edge of road	Provides similar parking capacity as existing conditions, with shortfalls only experienced on weekends during the peak season. Provides benefits to the floodplain by being rotated parallel to flow. Water quality and habitat benefits from vegetated swales between parking rows. Provides improved safety by constructing grade-separated pedestrian path.	Results in disturbance of existing riparian forest. Construction-related impacts, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife. Aesthetic impacts to residents near the lot.	Impairment is not likely to occur.
Alternative B5	• 200 cars at beach • Pedestrian path on Pacific Way Bridge and at edge of road	Provides greatest parking capacity, with very small (1-car) shortfalls on weekends during the peak weekend. Water quality and habitat benefits from vegetated swales between parking rows. Provides improved safety by constructing grade-separated pedestrian path.	Results in disturbance of existing riparian forest. Construction-related impacts, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife. Aesthetic impacts due to larger footprint.	Impairment is not likely to occur.
Alternative C	• 118 cars at Alder Grove adjacent to Hwy 1 • Pedestrian trail from Alder Grove to beach • Transit turnaround at beach • Pedestrian path on Pacific Way Bridge and at edge of road	Small footprint at the beach, with benefits to aesthetics, habitat and floodplain function. Water quality and habitat benefits from vegetated swales between parking rows. Provides improved safety by constructing grade-separated pedestrian path.	Substantial parking shortfalls, including inadequate parking during all weekends and on weekdays during the peak season. Results in disturbance of existing riparian forest at Alder Grove. Aesthetic, traffic and safety impacts due to location on Hwy 1, and trail to beach. Construction-related impacts, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife.	Impairment is not likely to occur.
Bridge Alternatives				
Alternative BR0	• No Action—existing Pacific Way Bridge is not replaced	Eliminates construction-related effects of the action alternatives.	Allows for continued flooding of Pacific Way, including issues related to emergency access. Restricts vehicle access to one-way traffic across bridge.	Impairment is not likely to occur.

Table 2-8. Continued

Alternative	Important Features	Beneficial Effects	Adverse Effects	Conclusions Regarding Resource Impairment
Alternative BR1	• 50-foot bridge span • Raised roadway	Substantially alleviates flooding of Pacific Way. Allows for 2-way traffic and a pedestrian walkway.	Raises flood elevations upstream. Would reduce floodplain width, limit sediment conveyance, and the ability for the channel to migrate over time. Construction-related effects, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife. Aesthetic effects from new bridge.	Impairment is not likely to occur. Increased potential for the narrow bridge span to impact the value of Redwood Creek by reducing floodplain connectivity and natural channel function.
Alternative BR2	• 50-foot bridge span • Low roadway	Alleviates flooding of Pacific Way somewhat. Reduces flood elevations upstream. Allows for 2-way traffic and a pedestrian walkway.	Reduces floodplain connectivity, ability for the channel to migrate over time, and increases the potential for channel avulsion. Construction-related effects, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife. Aesthetic effects from new bridge.	Impairment is not likely to occur. Increased potential for the narrow bridge span to impact the value of Redwood Creek by reducing floodplain connectivity and natural channel function.
Alternative BR3	• 150-foot bridge span • Raised roadway	Substantially alleviates flooding of Pacific Way. Allows for 2-way traffic and a pedestrian walkway. Improves channel stability, floodplain connectivity, natural channel function, and fish passage conditions.	Construction-related effects, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife. Aesthetic effects from longer and higher bridge.	Impairment is not likely to occur.
Alternative BR4	• ~~266–300~~ 250 foot bridge span (reduced from 266-300 feet) • Spans entire floodplain	Alleviates flooding of Pacific Way to the greatest extent. Reduces flood elevations upstream. Allows for 2-way traffic and a pedestrian walkway. Offers greatest benefits with respect to channel stability, floodplain connectivity, natural channel function, and fish passage conditions.	Construction-related effects, including air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities and wildlife. Aesthetic effects from longest and highest bridge.	Impairment is not likely to occur.

Table 2-8. Continued

Alternative	Important Features	Beneficial Effects	Adverse Effects	Conclusions Regarding Resource Impairment
Fill Disposal Alternatives				
Unused Reservoir Pit	• Materials used to fill in existing man-made pit. • 0.75 mile haul distance	Would contribute to restoring existing manmade feature to natural conditions. Relatively short haul distance.	Fill disposal activities would be visible from the Coastal Trail. Effects of fill disposal include air quality, water quality, noise, aesthetics, visitor experience, and traffic.	Impairment is not likely to occur.
Upper Banducci Fields	• Materials spread in agricultural field • 0.5 mile haul distance	Shortest haul distance.	Would require construction of temporary creek crossing for site access. Effects of fill disposal include air quality, water quality, noise, aesthetics, traffic, natural communities, and wildlife.	Impairment is not likely to occur.
Hamilton Air Force Base Wetlands Restoration	• Materials used to help complete large tidal wetland restoration • 20 mile haul distance	Would contribute to large wetland restoration.	Long haul distance would increase traffic and emissions. Effects of fill disposal include air quality, water quality, noise, aesthetics, and traffic.	Impairment is not likely to occur.
Dias Ridge Trail Recontouring	• Materials used to repair trail • 2.5 mile haul distance	Would repair existing degraded trail. Relatively short haul distance.	Would temporarily impede hiking on the Dias Ridge Trail. Effects of fill disposal include air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities, and wildlife.	Impairment is not likely to occur.
Coastal Trail Recontouring	• Materials used to repair trail • 0.75 mile haul distance	Would repair existing degraded trail. Relatively short haul distance, and would not involve hauling on public roadways.	Would temporarily impede hiking on the Coastal Trail. Effects of fill disposal include air quality, water quality, noise, aesthetics, visitor experience, traffic, natural communities, and wildlife.	Impairment is not likely to occur.

visitor experience, and community and traffic effects related to reduced parking lot capacity. In addition, it avoids the adverse effects to aesthetics and biological resources of the larger lot and the remote lot. The additional disturbance to the natural environment from rotation of the lot is offset by the long-term benefits in terms of site geomorphology and floodplain function; Public Access Alternative B3 still would obstruct the processes of rare, very large magnitude events.~~Public Access Alternative B3 is considered the environmentally preferable Public Access Alternative. It does not have the potential for reduced visitor experience, or traffic effects related to reduced parking lot capacity. In addition, it avoids the adverse effects to aesthetics and biological resources of the larger lot and the remote lot. This alternative will create a minimum distance of about 180 feet from the creek expanding to 240 feet where the available width is currently 50 feet, and there will also be an unobstructed floodplain on the opposite side of the creek for the first time. With this available area, this alternative fully achieves the primary purpose of parking lot modifications, which is to avoid impacts to high flows and upstream flooding. In addition, this alternative it will not increase the footprint of the parking lot on wetlands since it is about the same size as the existing lot, helping the project avoid a net loss of jurisdictional wetland area due to fill placement.~~

Alternatives that reduced or expanded the capacity of the parking lot were not identified as environmentally preferable because of the reduced visitor experience and traffic impacts that would result from either scenario. ~~Alternative B4 (the same existing capacity but a different configuration) was not selected as the environmentally preferable alternative because its larger size would cause a greater loss of mature riparian habitat and a potential net loss in jurisdictional wetland habitat, without substantial added benefits for channel function or flood reduction.~~

Bridge Alternatives

Technical studies conducted as part of this Final EIS/EIR examined flood behavior and sedimentation for a range of bridge length and bridge location alternatives. In general, these studies found that wider bridge spans resulted in less backwater effect upstream and less scour at the bridge opening. Bridge Alternative BR4 has been determined to be the environmentally preferable Bridge Alternative. Construction-related effects are anticipated to be similar among all the Bridge Alternatives. However, the longer span of Bridge Alternative BR4 would reduce upstream flooding to the greatest extent and would allow the greatest level of all-weather access; this bridge would provide access during a very large magnitude event (i.e., much larger than a 10-year event and probably as close as possible to a 100-year event). Its ultimate capacity would be determined during project design, when other design constraints can be fully considered simultaneously by bridge engineers ~~by locating the bridge entirely above the 100-year flood elevation~~. In conjunction with Alternative B4, this alternative would provide the greatest level of natural stream function by allowing adequate room for natural hydrological processes such as channel migration to reestablish, which would in turn improve salmonid habitat. ~~and~~

~~floodplain connectivity.~~ Its long span would also reduce upstream flooding to the greatest extent.

Alternative BR3 was not identified as the environmentally preferable alternative because under some large flood events, the bridge would still be overtopped by floodwaters, though it would remain passable for vehicles. Shorter bridges were not identified as environmentally preferable because they would be joined by either a low or a raised road connection; a low road would ~~result in frequent flooding events similar to existing conditions~~ be subject to inundation during flood events, while a raised road would result in higher flood elevations that would potentially cause more damage compared to existing conditions.

Fill Disposal Alternatives

The Unused Reservoir Pit is considered the environmentally preferable Fill Disposal Alternative. This is because it would have a relatively short haul distance, would not involve extensive site upgrades to allow for fill disposal, and would restore an existing man-made feature to a more natural configuration. While other alternatives may have shorter haul distances (e.g., Upper Banducci Field), or provide for similar if not greater ecological benefits (Hamilton Wetlands Restoration), they do not offer the same combination of minimizing adverse impacts while maximizing beneficial impacts.

Comparison of Alternatives

Table 2-8 provides a summary comparison of the alternatives analyzed, including beneficial and adverse effects. All alternatives are generally consistent with local plans. All action alternatives would meet the project purpose and need and would be consistent with the intent of CEQA, NEPA and other applicable environmental laws and policies. The No Action Alternative would not satisfy project purpose and need. Potential environmental consequences and consistency with local plans are analyzed in more detail in Chapter 4, *Environmental Consequences*.