Chapter 4 – Environmental Consequences

4.1 Introduction

This chapter provides an analysis and evaluation of the environmental consequences of implementing the alternatives described in Chapter 2. Impact evaluation has been conducted for each aspect of the environments described in Chapter 3 – Affected Environment, including physical, biological, cultural, and socio-economic resources. The adverse and beneficial effects of implementing each alternative are generally described in three main action categories – Habitat and Wildlife Management, Habitat Enhancement/Restoration, and Public Use Program. The cumulative effects on the environment of implementing the various alternatives are presented in Section 4.9.

4.2 Effects to the Physical Environment

Topics addressed under the physical environment section include direct and indirect effects to topography, visual quality, geology, soils, agricultural resources, air quality, noise, hydrology, and water quality. Cumulative effects to the physical environment are addressed in Section 4.9.2.1. The criteria used in this document to determine if a particular impact represents a significant adverse effect are present below for each topic.

- Topography – An adverse topographic effect is considered significant if grading is proposed in a highly scenic area or would alter a locally or regionally important topographic landmark, or proposed grading would substantially alter the existing landform by creating manufactured slopes higher than ten feet or steeper than 2:1 (50 percent).

- Visual Quality – A proposal that would substantially alter the natural landform or block public views to a public resource (such as San Diego Bay) from designated open space areas or public roads would be considered a significant adverse effect on visual quality.

- Geology/Soils – Impacts related to geology and soils would be considered significant if a proposed action would trigger or accelerate substantial slope instability, subsidence, ground failure, or erosion affecting onsite facilities or adjacent facilities, such as roadway and railway embankments and bridge abutments and pilings. Impacts would also be considered significant if a project design were more susceptible to geohazards, such as liquefaction, settlement, ground rupture, or lateral spreading.

- Agricultural Resources – A significant adverse effect on agricultural resources would occur if a Refuge action would result in the conversion of Prime Farmland or Farmland of Statewide Importance to non-agricultural use (refer to Section 3.3.4 for more information regarding these designations).

- Hydrology – An adverse hydrologic effect is considered significant if an action would result in increased flooding on- or off-site, a net deficit in the aquifer volume, or a reduction in the local groundwater table.

- Water Quality – Adverse impacts to water quality would be considered significant if the action would violate any water quality standards or waste discharge requirements, substantially increase downstream sedimentation, introduce contaminants (non-point source pollution) into the watershed, or otherwise substantially degrade water quality.

- Air Quality - Implementation of a proposed Refuge action would have a significant direct effect on air quality if the action would result in emissions equal to or in excess of the standards outlined in Rule 1501 of the APCD Rules and Regulations (refer to Section 3.3.7); sensitive receptors are exposed to substantial pollutant concentrations, including air toxics such as diesel particulates; or air contaminants are released beyond the boundaries of the Refuge. Significant indirect effects to air quality would occur if a proposed Refuge action results in the degradation of the existing level of service on adjacent roadways. Significant cumulative effects would occur if the "de minimis" (minimum) thresholds developed by the EPA for proposed Federal actions in a non-attainment area are exceeded (refer to Section 3.3.7).

- Noise – An action that generates noise levels at the property line in excess of the affected city's noise standards would be considered a significant adverse effect. Indirect noise impacts to sensitive wildlife are addressed under Effects to Wildlife (Section 4.4).

4.2.1 Sweetwater Marsh Unit

4.2.1.1 Alternative A – No Action

4.2.1.1.1 Effects to Topography/Visual Quality

Habitat and Wildlife Management

Under the no action alternative annual disking and general site preparation to maintain suitable nesting habitat for California least tern and western snowy plover on the D Street Fill would continue, as would other habitat and wildlife management actions, such as trash clean-up, periodic control of invasive plants, and general control of public access. None of these activities would result in any significant direct or indirect adverse effects to the existing site topography or visual quality. Some minor beneficial effects to visual quality would result from removing unsightly trash and controlling weeds along access points into the Refuge.

As described in Section 2.2.2.1, until 2010 restoration of the mitigation leasehold overlays could occur under this or any of the other alternatives proposed for the Sweetwater Marsh Unit. Such actions would be initiated by an entity other than the Service and no restoration plans are currently available for these sites. To restore areas such as the D Street Fill to tidal influence would result in changes in the landform. Specifically, the area would have to be excavated to achieve elevations that support intertidal habitat. These changes are not anticipated to result in any significant adverse impacts to topography or visual quality; however, without the specific restoration details, an analysis of potential effects is not possible at this time. Subsequent environmental analysis consistent with NEPA would be required when specific details regarding the restoration plans are provided to the Refuge Manager for review and approval.

Public Use

The continuation of the public use programs currently conducted on the Sweetwater Marsh Unit would not result in any significant adverse effects to topography/visual quality.

4.2.1.1.2 Effects to Geology, Soils, and Agricultural Resources

Habitat and Wildlife Management

No unique geologic features occur within this Unit and no active faults have been identified in the immediate area. The site would however be subject to seismic ground shaking or seismically induced liquefaction in the event of a large magnitude earthquake on one of the faults in the San Diego region. Therefore, the access road and other structures present on this Refuge Unit could sustain damage in the event of such an earthquake. Under this alternative, no new structures are proposed; therefore, hazards and the potential for structural damage due to seismic ground shaking or seismically induced liquefaction in the event of an earthquake would remain unchanged and are considered low.

No significant changes to soils or sediments are anticipated as a result of the continuation of current management actions. The potential for low levels of erosion and sedimentation resulting from ground disturbing activities (disking and removal of annual weedy plants) associated with nest site preparation at the D Street Fill would continue, but are not considered significant.

No significant agricultural resources were identified on this Refuge Unit; therefore, the implementation of this alternative would not adversely affect agricultural resources.

Public Use

No adverse or beneficial effects related to geology, soils, or agricultural resources would result from the continuation of the current public use activities conducted on this Refuge Unit.

4.2.1.1.3 Effects to Hydrology and Water Quality

Habitat and Wildlife Management

Implementation of the no action alternative would maintain the current hydrologic conditions within the Refuge Unit, resulting in the continuation of ongoing sedimentation within the primary tidal channel in Paradise Marsh, as well as within the various tidal channels in Sweetwater Marsh. No changes in the current flood characteristics of the area, including flood frequency or duration, would result. The entire area within the Refuge Unit that supports salt marsh habitat, as well as the northwestern most portion of Gunpowder Point and the easterly end of D Street Fill, would continue to be subject to flooding in a 100-year storm event. As no changes in the current conditions are proposed by the Service, no significant effects related to hydrology are anticipated.

Potential future restoration of the mitigation leasehold overlays would require additional hydraulic and water quality analysis to evaluate the impacts, if any, of restoration within the floodplain or intertidal zone on uses in the vicinity of the restoration project.

The control of invasive plant species would continue to be implemented on this Refuge Unit. Control would involve mechanical removal and the periodic application of herbicides, particularly in the disturbed upland areas that border the marsh. Although mechanical removal has the potential to expose soils to wind and water erosion, this activity would be to the use of hand tools and would focus on individual plant removal, rather than the removal of large areas of vegetation. Therefore, the continuation of this control method is not expected to introduce additional sediments into the marsh complex. The use of herbicides to control invasive plants also poses several environmental risks, including drift, volatilization, persistence in the environment, water contamination, and harmful effects to wildlife (*Bossard et al. 2000*). The potential for such risks under this alternative are

considered minimal due to the types and limited quantities of herbicides used and the precautionary measures taken during application.

Public Use
No adverse effects to hydrology or water quality would result from the continuation of the current public use programs.

4.2.1.1.4 Effects to Air Quality

Habitat and Wildlife Management
Factors that could affect air quality, such as visitor-related traffic generation, would not change from current conditions. Therefore, implementing Alternative A would result in no significant changes over existing conditions.

Potential future restoration of the mitigation leasehold overlays would require additional air quality analysis, as temporary increases in air emissions would occur during excavation and other construction related activities.

Public Use
Maintaining the current public use programs would not adversely affect air quality.

4.2.1.1.5 Effects to Noise

Habitat and Wildlife Management
The continuation of current activities on the Refuge would not generate noise of sufficient volume to impact any existing or future sensitive receptors in the general vicinity; therefore, no significant adverse noise impacts are anticipated as a result of implementing Alternative A.

Public Use
The continuation of the public use programs currently conducted on the Sweetwater Marsh Unit would not alter the existing noise conditions within the vicinity of this Refuge Unit.

4.2.1.2 Alternative B – Habitat Enhancement/Interpretation

4.2.1.2.1 Effects to Topography/Visual Quality

Habitat and Wildlife Management
Conducting the habitat and wildlife management activities currently occurring on the Sweetwater Marsh Unit, as well as the additional activities associated with mapping endangered, threatened, and sensitive plant species; monitoring of federally listed endangered and threatened avian species; and expanding efforts to control invasive plant species would not result in adverse effects to topography or visual quality.

Habitat Enhancement
Alternative B would involve the design and implementation of several habitat enhancement activities that would alter the existing landform within this Unit. These changes are not considered significant because the landforms to be altered were created as the result of previous human disturbance. Specific changes include the partial or complete removal of fill from an abandoned roadbed that extends east/west across Sweetwater Marsh; the potential removal of an old berm constructed between San Diego Bay and the southern tip of Sweetwater Marsh; the installation of an additional culvert under the roadway currently used to access Gunpowder Point; and lowering or removing the weir at the southern end of

Paradise Marsh. None of these proposals would adversely alter the natural landform on the Refuge, block public views, or degrade the visual quality of the area.

The proposed expansion of the area subject to annual disking and general site preparation on the D Street Fill to accommodate seabird nesting would not adversely affect topography, natural landform, or visual quality.

Public Use
The addition of new interpretive signage in the vicinity of Paradise Marsh and the F&G Street Marsh would not result in any significant adverse effects to topography/visual quality.

4.2.1.2.2 Effects to Geology, Soils, and Agricultural Resources

Habitat and Wildlife Management
No adverse effects to geology, soils, and agricultural resources from the implementation of the management activities proposed under Alternative B are anticipated.

Habitat Enhancement
The existing hazards and potential for structural damage to the main access road and other structures as a result of seismic ground shaking or seismically induced liquefaction would not change as a result of the enhancement proposals included under this alternative. As no significant agricultural resources were identified within this Refuge Unit, this alternative would not adversely affect agricultural resources.

Public Use
No adverse or beneficial effects related to geology, soils, or agricultural resources would result from the implementation of the public uses proposed under this alternative.

4.2.1.2.3 Effects to Hydrology and Water Quality

Habitat and Wildlife Management
Expanding invasive plant species control, as described for Alternative B, would not substantially alter the conclusions presented under Alternative A within respect to hydrology and water quality.

Habitat Enhancement
The proposed improvements to tidal circulation and the expansion of seabird nesting opportunities would alter the hydrology and could affect water quality within this Refuge Unit. Specifically, changes in wetland hydrology would result from the removal of fill material that currently impedes tidal circulation through Sweetwater Marsh. The reconnection of the historic tidal channels in this area would be accomplished by removing an abandoned roadbed, installing an additional box culvert within the main access road, and possibly removing a berm located between the bay and the southern end of Sweetwater Marsh. By removing these existing impediments to tidal flow, new secondary and tertiary tidal channels could develop over time that would improve overall habitat quality within the marsh. Removal of the abandoned roadbed could also improve circulation of freshwater flows through the southern end of Sweetwater Marsh during storm events. All of these proposals would provide significant beneficial effects to hydrology and water quality as a result of improved tidal circulation within this Refuge Unit.

The excavation required to implement these improvements could result in temporary increases in turbidity within the tidal channels and the addition of sediments into the channels during excavation. To remove the abandoned roadbed fill that crosses Sweetwater Marsh (see Figure 2-3), it would be necessary to excavate an estimated 7,500 cubic yards of fill material using conventional land based construction equipment. Short term adverse impacts to water quality, would be minimized by scheduling construction activities to avoid periods of extreme high tide. Best Management Practices (BMPs) would also be implemented to minimize that potential for sedimentation into the adjacent channels during excavation. Construction staging and access routes would be located in stable upland areas; silt fences would be installed around construction areas; and, if necessary, cofferdams would be used to minimize erosion and sedimentation into the adjacent marsh. The implementation of these measures would reduce the potential for increased sedimentation to below a level of significance.

Installing an additional box culvert under Gunpowder Point Drive could also result in temporary increases in turbidity and sedimentation within the adjacent marsh channels. To minimize these impacts, use of construction vehicles would be confined to the existing roadway and construction would be timed to avoid extreme high tides. In addition, silt fencing and, if necessary, cofferdams would be installed to minimize impacts related to erosion and sedimentation. Revegetation of any disturbed areas would occur immediately upon completion of construction. The implementation of these measures would reduce the potential for water quality impacts to below a level of significance.

To avoid any unanticipated impacts to water quality, prior to excavation, a site assessment would be completed to determine the presence or absence of contaminants within the fill material to be removed. If contaminants are present, appropriate remediation would be implemented prior to or in association with the proposed excavation.

This alternative also contemplates the removal of a berm previously constructed between the bay and the southern end of Sweetwater Marsh (see Figure 2-3). Prior to developing construction plans to implement this proposal, a hydrological assessment of the proposal would be conducted to determine how this action would alter the existing marsh hydrology. Construction methods intended to minimize impacts related to erosion and sedimentation would be incorporated into future grading plans. The amount of excavation required to accomplish this action is unknown at this time. If after completing the final restoration plans, new impacts are identified, additional analysis under NEPA would be required.

To improve tidal circulation in Paradise Marsh, this alternative also proposes to lower or remove an existing weir located at the terminus of Paradise Creek. Previous hydrologic monitoring in this area established that the weir is causing tidal damping and sediment deposition in the marsh's main tidal channel. Lowering the weir by as much as 2.5 feet would avoid any further deposition (Philip Williams & Associates 1993, 1995). Altering the existing weir could result in limited short-term impacts related to increased sedimentation primarily within the flood control channel. However, the benefits to the marsh in terms of improved tidal circulation would far exceed the short-term adverse effects of increased sedimentation that could occur immediately following project implementation.

Lowering or removing the weir could also result in changes to the existing groundwater conditions within the marsh. Specifically, the direction in which groundwater currently flows could be reversed, with flows that currently move toward the north returning to a more natural condition in which groundwater would flow toward the bay. Because of the

potential presence of contaminants in the groundwater upstream of this Refuge Unit, this reversal in flow could introduce contaminants into the marsh. Prior to implementing this proposal, additional analysis of the groundwater conditions upstream of Paradise Marsh would be conducted to ensure that no contaminants are inadvertently introduced into the marsh. All contaminants analysis would be conducted in coordination with the Service's Division of Environmental Contaminants.

Habitat enhancement is also proposed for a portion of the D Street Fill. Under this alternative, the area prepared for California least tern and western snowy plover nesting would be expanded from 17 acres to 30 acres and the slopes along the southwestern edge of the D Street Fill would be recontoured to reduce the slope gradient between the nesting area and the adjacent marsh. Although this could expose an additional 13 acres of soil to wind and water erosion, the material on the D Street Fill generally consists of sandy soils that have a low susceptibility to erosion. In addition, the site is relatively flat, which further reduces the potential for measurable erosion. Increasing the area prepared for seasonal nesting is not expected to significantly increase erosion or sedimentation into wetlands. Recontouring the eroded slopes would reduce erosion and sedimentation onto the adjacent mudflats. These improvements would provide modest benefits to the goal of protecting water quality in this portion of the bay.

Public Use

No adverse effects to hydrology or water quality would result from the implementation of the public uses proposed under this alternative.

4.2.1.2.4 Effects to Air Quality

Habitat and Wildlife Management

No adverse effects to air quality from the implementation of the management activities proposed under Alternative B are anticipated.

Habitat Enhancement

The San Diego County APCD has not established specific criteria for assessing air quality impacts related to land excavation activities, such as those required to implement the proposed enhancement projects. Although limited in duration, the emissions from these types of activities can cause adverse air quality impacts if they are large enough in scope. Rule 1501 of the APCD Rules and Regulations (as described in Section 3.3.7) states that a conformity determination is required for each pollutant where the total direct and indirect emissions in an area caused by a Federal action would equal or exceed acceptable rates.

The construction activity required to implement the proposed enhancement projects would produce temporary increases in combustive and fugitive dust (PM_{10}) emissions as a result of the operation of mobile earthmoving and construction equipment. Each of the proposed actions would be accomplished in a relatively short period of time (some lasting a few weeks, while others not exceeding two months in duration). The total emissions generated from the combined enhancement proposals are not expected to exceed the rates established for Federal actions. However, additional analysis would be conducted for these proposals once specific engineering plans have been developed. The requirements of Rule 1501 would only be applied to this proposal if it is determined that the rates established for Federal action would be exceeded.

Public Use
Implementing the public uses proposed under Alternative B would not result in any adverse effects to air quality.

4.2.1.2.5 Effects to Noise

Habitat and Wildlife Management
The implementation of the habitat and wildlife management activities proposed under Alternative B would not result in any increases in the current noise levels generated from within this Refuge Unit, therefore, no adverse effects related to noise are anticipated.

Habitat Enhancement
The construction activity associated with the proposed enhancement projects would temporarily increase noise levels in the surrounding area; however, the noise would not be of sufficient volume to impact any existing or future sensitive receptors (e.g., residential housing, commercial development) in the general vicinity of the Refuge.

Public Use
Implementing the public uses proposed under Alternative B would not alter the existing noise conditions within the vicinity of this Refuge Unit.

4.2.1.3 Alternative C – Habitat Restoration/Enhance Public Use (Preferred Alternative)

4.2.1.3.1 Effects to Topography/Visual Quality

Habitat and Wildlife Management
The habitat and wildlife management actions proposed under Alternative C expand upon the proposals already addressed under Alternative B by incorporating proposals to improve habitat conditions for salt marsh bird's beak and to participate in local and regional watershed planning programs. Implementing these management activities would not result in any significant adverse effects to topography/visual quality.

Habitat Restoration
The habitat enhancement activities described in Alternative B would also be implemented under this alternative. As stated above, the landform alterations associated with these enhancements are minor and would not adversely impact the area topography or visual quality. In addition to habitat enhancement, Alternative C also includes a number of habitat restoration proposals. These restoration proposals would result in minor modifications to the existing topography within some portions of the Refuge. The most extensive of these alterations would occur in association with the future restoration of approximately 13 acres at the eastern end of the D Street Fill. Restoring this area to intertidal habitat would involve lowering the site from 13 feet MLLW to an elevational range of between –1 feet MLLW and +9 feet MLLW. The excavation would convert the existing landform from a relatively flat surface to a gently sloping marsh plain. The resulting landform would be more representative of the historic landscape and would not be considered a significant adverse effect.

Salt marsh restoration is also proposed at the northern end of the F&G Street Marsh and the northern edge of Gunpowder Point (refer to Figure 2-4). The minor changes in the existing landform associated with these proposals would result in a landform that more closely resembles the historic topographic character of the area. These changes are not considered significant in terms of landform alteration or visual quality.

Public Use
No significant adverse effects to topography/visual quality are anticipated as a result of implementing the public use program proposed under this alternative.

4.2.1.3.2 Effects to Geology, Soils, and Agricultural Resources

Habitat and Wildlife Management
No adverse effects to geology, soils, or agricultural resources are anticipated as a result of implementing the habitat and wildlife management activities proposed under Alternative C.

Habitat Restoration
The existing hazards and potential for structural damage to the Refuge's main access road and other structures as a result of seismic ground shaking or seismically induced liquefaction would remain unchanged.

Restoration of a portion of the D Street Fill to coastal wetlands would result in the need to dispose of the soil removed during excavation. If the excavated material consists of clean sand of an appropriate grain size, it would most likely be used for beneficial uses, such as nesting substrate for tern nesting areas or for beach replenishment. If the material is not appropriate for these uses, other potential disposal options include off-site disposal within an approved development project, offshore disposal within an approved ocean disposal site, or disposal within an existing landfill. The actual disposal option selected would be dependent upon the structural and chemical characteristics of the soil, the availability of off-site disposal sites, and the cost of disposal.

No significant agricultural resources were identified on Refuge lands; therefore, the implementation of this alternative would not adversely affect agricultural resources.

Public Use
No significant adverse effects to geology, soils, or agricultural resources are anticipated as a result of implementing the public use program proposed under this alternative.

4.2.1.3.3 Effects to Hydrology and Water Quality

Habitat and Wildlife Management
The effects to hydrology and water quality of implementing the proposed habitat and wildlife management actions would be the same as described for Alternative B.

Habitat Restoration
As discussed under Alternative B, changes in wetland hydrology would result from the implementation of enhancement proposals intended to improve tidal circulation within the Refuge. These changes would result in moderate long-term benefits to the Refuge's salt marsh habitat. There is, however, the potential for short-term adverse impacts associated with the excavation required to implement these improvements. Such impacts, which could result from temporary increases in turbidity and sedimentation within tidal channels, would be minimized through the implementation of BMPs during construction.

The effects to hydrology and water quality from implementing the proposed restoration projects would be similar to those previously described for habitat enhancement under Alternative B. As noted in Chapter 2, the restoration proposals are preliminary in nature; no specific engineering has been conducted. Therefore, the analysis of environmental

consequences is somewhat generic. Additional analysis would be conducted following the completion of specific restoration plans for each site. If new impacts are identified during final restoration planning, additional review under NEPA would be conducted.

Salt marsh restoration of approximately 13 acres is proposed for the east end of the D Street Fill. This restoration could occur in one action or as a series of actions and would involve excavating and/or dredging to achieve elevations suitable for establishing salt marsh habitat. These activities would result in short-term increases in suspended sediments and turbidity levels in the open water and tidal channel habitats adjacent to the restoration area. Such impacts would be temporary and could be minimized through appropriate BMPs, including the use of berms, silt curtains, cofferdams, and similar construction techniques.

Another two acres of salt marsh restoration is proposed along the northern edge of Gunpowder Point where fill was pushed into the marsh sometime in the past to expand the area available for crop production. Grading activities would involve removing the fill and restoring to area to elevations ranging from approximately +6 MLLW to +3.5 MLLW. To minimize water quality impacts related to sedimentation and turbidity, a silt curtain or other appropriate barrier would be maintained around the perimeter of the excavation area during grading.

Contaminant levels present in some samples taken from the sediments and fill materials located within the F&G Street Marsh indicate a potential threat to water quality within the marsh and the bay. Exposing these soils to tidal action could result in the release of contaminants into the water column. To avoid such impacts, future restoration plans would include measures to remediate contaminants where appropriate, as well as protect adjacent waters from potential contamination during excavation. All restoration planning for this area would be coordinated with the Service's Division of Environmental Contaminants.

Impacts to hydrology and water quality from the restoration of upland and upland transition habitat on Gunpowder Point are not expected to be significant. Restoring this area would not require extensive grading. The potential for erosion and sedimentation into the adjacent marsh would be minimized by placing a silt curtain around the perimeter of the restoration area.

A site assessment would be completed prior to any excavation to determine the presence or absence of environmental contaminants. This measure would be implemented to avoid significant long-term impacts to water quality from any of the proposed enhancement or restoration projects. If contaminants are present, appropriate remediation would be implemented prior to or in association with the proposed excavation.

Public Use

The changes to the existing trail system proposed under Alternative C (i.e., construction of new trail segments, the closure of some existing trails, and/or the installation of new interpretive elements) could temporarily expose the soil to water and wind erosion. Such exposures would be minimal and would not represent a significant adverse effect. Long-term erosion problems associated with a redesigned trail system would be avoided by implementing sound trail construction techniques.

4.2.1.3.4 Effects to Air Quality

Habitat and Wildlife Management

The effects to air quality of implementing the proposed habitat and wildlife management actions would be the same as described for Alternative B.

Habitat Restoration

The construction activity required to implement restoration under this alternative would produce temporary increases in combustive and fugitive dust (PM_{10}) emissions as a result of the operation of mobile earthmoving and construction equipment. Each of the projects would be relatively small in scope and would most likely be implemented in phases; consequently, the total emissions generated from the combined enhancement and restoration proposals are not anticipated to meet or exceed the emission limits described in Rule 1501 of the APCD Rules and Regulations.

Public Use

The expanded opportunities for public use would result in some increases in car and bus trips to and from the Refuge Unit; however, the majority of these trips would occur during off-peak traffic hours. Therefore, the increase in trips would not be expected to adversely affect the current level of service on the surrounding street system, nor would it result in the generation of air emissions that would meet or exceed the standards established in Rule 1501 of the APCD Rules and Regulations.

4.2.1.3.5 Effects to Noise

Habitat and Wildlife Management

The management proposals included within this alternative would not increase noise levels within or adjacent to this Refuge Unit.

Habitat Restoration

The construction activities associated with proposed restoration would temporarily increase noise levels in the vicinity of the projects; however, the noise generated by the construction equipment would not produce noise of sufficient volume to impact sensitive receptors in the general vicinity of the Refuge Unit. A potential exception would be restoration activities within F&G Street Marsh where planning for future development is currently underway. If uses sensitive to elevated noise levels (e.g., residential development) are constructed in proximity to the F&G Street Marsh, construction noise from restoration activities could adversely affect these uses.

In general, construction equipment, such as backhoes and dump trucks, generate an hourly average noise level of about 85 dBA at an equivalent distance of 50 feet, while front-end loaders and cranes with buckets generate a noise level of about 90 dBA at 50 feet. An electrified hydraulic dredge would be expected to produce lower noise levels, somewhere in the range of 72 to 75 dBA at 50 feet. The noise levels from such equipment would reduce at the rate of about 6 dBA with each doubling of the distance from a sensitive receptor, such as adjacent residences.

Additional evaluation of potential noise impacts would be conducted prior to the implementation of restoration at the F&G Street Marsh. Mitigation measures would be implemented to reduce excessive noise levels to below a level of significance if it is determined that noise levels at the property line would exceed accepted standards for adjacent development (refer to Section 3.3.9). Such mitigation could include ensuring that

all internal combustion engine-driven equipment is properly muffled, construction staging areas are located an adequate distance from any residential or commercial property lines, and, if necessary, temporary noise barriers are installed between the restoration site and sensitive receptors to minimize the impacts of construction noise on adjacent uses.

Public Use
The public use proposals included under Alternative C would not result in any changes to the existing noise levels within or adjacent to this Refuge Unit, therefore, no adverse effects related to noise are anticipated.

4.2.2 South San Diego Bay Unit

4.2.2.1 Alternative A – No Action

4.2.2.1.1 Effects to Topography/Visual Quality

Habitat and Wildlife Management
Under this alternative, no significant alteration of the existing landform would occur. Annual mowing of the abandoned agricultural fields on the Otay River floodplain to reduce the threat of wildfire and the spread of invasive plant species would continue; however, these activities would not adversely affect site topography or visual quality.

Habitat Enhancement
Two enhancement projects intended to improve nesting and foraging opportunities for the California least tern are included within this alternative. These projects are also components of all of the action alternatives (refer to Sections 1.7.3 and 2.3.1.1). The first project, levee surface enhancement, would involve placing sand on some levee tops to support seabird nesting. This activity would occur on existing manmade structures and would have little or no effect on site topography or visual quality.

The second project, which would improve foraging habitat for the California least tern, would involve breaching one of the salt ponds, most likely Pond 28 or 29, to facilitate tidal exchange within all or a portion of the pond. This action would have little effect on the topography or visual quality of the site, although the appearance of the affected pond would change from that of an open water or salt-crusted area to an area with water levels that vary with the tides.

Public Use
Continuing to allow fishing and recreational boating within the Refuge boundary and supporting the current opportunities for wildlife observation and environmental education would have no effect on topography or visual quality. In addition, no changes to the existing topography or visual quality on this Refuge Unit would occur as a result of continuing to produce salt within the salt ponds.

4.2.2.1.2 Effects to Geology, Soils, and Agricultural Resources

Habitat and Wildlife Management
No unique geologic features or active faults occur within the South San Diego Bay Unit; however, existing structures would be subject to seismic ground shaking or seismically induced liquefaction in the event of a large magnitude earthquake on one of the faults in the San Diego region. In such an event, the existing salt pond levees could sustain damage, although the potential for damage is considered low.

No significant soil alteration is proposed under this alternative. In addition, the implementation of this alternative would not adversely affect that portion of the Otay River floodplain that is designated as Prime Farmland by the California Department of Conservation (*2000*).

Habitat Enhancement
The depth of the sand to be placed on the levees under this alternative would be limited to approximately six to ten inches; therefore, this activity would have no effect on the stability of the existing levees. No adverse effects related to geology, soils, or agricultural resources are anticipated.

Public Use
The continuation of existing uses on this Refuge Unit would not result in any significant adverse effects to geology, soils, or agricultural resources.

4.2.2.1.3 Effects to Hydrology and Water Quality

Habitat and Wildlife Management
Habitat and wildlife management activities that would be implemented under this alternative would not result in any changes to the current water quality or hydrologic characteristics within the Refuge or the surrounding areas. The salt ponds, Otay River floodplain, and adjacent buildings to the south of the Refuge would continue to be subject to inundation during a 100-year flood. In addition, the southern outer levees of the salt ponds would be subject to overtopping in a 10-year or greater storm event (*Rick Engineering 1987*).

Some short-term effects to water quality could occur as a result of routine maintenance and occasional repairs to the outer levees. These effects would be limited in scope and short in duration, therefore, no significant adverse impacts are anticipated.

Habitat Enhancement
No adverse effects to bay waters or the adjacent channels that drain into the bay are anticipated from the placement of sand on the levees as these activities would be confined to the interior of the salt works.

Restoring foraging habitat could result in minor, temporary impacts to water quality immediately following pond breaching, as hypersaline water is introduced into the bay. The quality of hypersaline water discharged into the bay would be small and the effects of the increased salinities would be short lived, therefore, no significant adverse effects to water quality are anticipated.

Public Use
Recreational boating in the South San Diego Bay Unit is limited due to the shallow depths of the water; therefore, the continuation of boating at the present low levels would not adversely affect water quality in the bay. The current solar salt operation does not result in any discharge into the bay; therefore, no impacts to water quality are anticipated from the continuation of this use.

4.2.2.1.4 Effects to Air Quality

Habitat and Wildlife Management

The operation of maintenance equipment (e.g. light trucks, mowers, and other landscape equipment), which generate low levels of air emissions, would not increase from current conditions. Rule 1501 of the APCD Rules and Regulations states that future activities conducted in a similar scope and operation to activities currently being conducted would result in no air emission increases or if an increase in emissions does occur, it would be de minimis. As a result, no significant adverse impacts to air quality are anticipated under this alternative.

Habitat Enhancement

Air emissions generated by dump trucks and small bobcat tractors required to transport and place sand on the levees would be minimal and would not meet or exceed the standards set forth in Rule 1501 of the APCD Rules and Regulations.

Restoring foraging habitat under this proposal could involve removal of any salt from the pond surface, excavation or ripping of any gypsum crust, and other minor earthwork necessary to connect the pond to the bay to facilitate tidal exchange. These activities would be temporary and limited in scope; therefore, no adverse air quality impacts are anticipated.

Public Use

The limited recreational boating that occurs within this Refuge Unit would not adversely affect air quality within the region.

4.2.2.1.5 Effects to Noise

Habitat and Wildlife Management

The operation of maintenance equipment, which generates low levels of noise, would not increase from current conditions. As a result, no significant adverse impacts related to noise are anticipated under this alternative.

Habitat Enhancement

Noise produced during the operation of construction equipment used to enhance nesting habitat for least terns at the salt works or to breach a pond levee to improve foraging habitat would not exceed adopted noise standards at the Refuge boundary; therefore, no significant noise impacts would be anticipated.

Public Use

Boating activity within the Refuge Unit is subject to an existing five mph speed limit; therefore, excessive noise from this activity is not anticipated.

4.2.2.2 Alternative B –Enhance Nesting Habitat

4.2.2.2.1 Effects to Topography/Visual Quality

Habitat and Wildlife Management

The control of invasive plant species along the Otay River channel and the subsequent planting of appropriate native vegetation is not be expected to result in any adverse effects to site topography or visual quality. The control of accumulated fishing line and other debris around the outer levees could provide minor beneficial effects related to visual quality.

Habitat Enhancement
Implementing the nesting enhancements proposed under this alternative would involve importing fill material onto the site to widen and/or recontour the existing levees and create several new nesting areas within the ponds. Estimates were developed based on the enhancement proposals illustrated in Figure 2-7 (refer to Section 2.3.2.2 and Tables 2-5 and 2-6) to gain a general understanding of the extent of material that would be required to achieve these enhancements. The actual volumes of fill material and sand required to implement these enhancements would be determined in association with the development of final restoration plans.

An estimated 300,000 to 500,000 cubic yards of fill material would be required to widen some levees, recontour the side slopes of other levees, and build new nesting areas in certain salt ponds. An additional 65,000 cubic yards of clean sand would have to be imported to cap the new and enhanced nesting areas. The majority of this material would be placed in the water area of the ponds; therefore, the total area of upland (exposed land) within the salt works would increase by only 2 to 3 percent, representing a relatively minor change in the site's topography and visual quality as viewed from the areas surrounding the Refuge. No significant impacts related to landform alteration or visual quality are therefore anticipated.

The effects of implementing required foraging habitat for the California least tern would be the same as discussed above.

Public Use
Under this alternative, no changes would occur to the public use program currently implemented on the Refuge; therefore, as in Alternative A, no adverse effects to topography or visual quality, are anticipated. Solar salt production would continue in essentially the same configuration as described for Alternative A, although minor changes in the configuration of the salt ponds are proposed to facilitate nesting enhancements. As described in Alternative A, no adverse effects to topography or visual quality would result from the continued operation of the salt works.

4.2.2.2.2 Effects to Geology, Soils, and Agricultural Resources

Habitat and Wildlife Management
The control of invasive plant species along the Otay River channel would not result in any adverse effects to site geology, soils, or agricultural resources.

Habitat Enhancement
This alternative proposes to add fill material and capped with a layer of sand to various ponds and levees within the salt works to enhance nesting opportunities. These materials would be placed on levees that are composed of hydraulic and non-hydraulic fill soils; soils that have not been tested for proper compaction during their placement (*GEOCON 1985*). Fill material needed to create nesting sites and widen levees would be placed on areas underlain by bay deposits (refer to Section 3.3.3.2.) characterized by high compressibility and low shear strength. These soil characteristics could result in some settlement following placement of the fill on the levees, which could lead to the instability of the submerged levee slopes.

The amount of settlement expected to occur following grading would be a function of how thick the existing compressible layer is, how compressible the layer is, and how heavy the new vertical load (weight of the new fill) would be (*GEOCON 1985*). Slope stability is

related in part to the steepness of the slope; the flatter the slope (3:1 or flatter), the less likely the slope would be subject to deep-seated failure. These factors would be considered during final engineering to ensure that the intended shape and elevation of the new and enhanced nest sites would be achieved. In addition, a qualified geologist would be retained to review the final enhancement plans and provide recommendations specific to the proposed enhancement activities.

Placement of fill material and sand within the salt works could result in some sedimentation into the ponds; however, no adverse effects to the adjacent bay or Otay River channel are anticipated. To avoid short or long-term erosion into the ponds and additional settlement of the newly created nesting areas, the suitability of the proposed fill material for use within the ponds would be determined prior to acquisition of the material. The shear strength of the fill material would also be considered and the slope gradient of the fills would be planned accordingly. The implementation of the various measures described above would reduce potential adverse effects related to geology and soils to below a level of significance.

The site would continue to be subject to seismic ground shaking or seismically induced liquefaction in the event of a large magnitude earthquake. Based on existing soil characteristics, the potential for liquefaction in the vicinity of the salt works would remain high; however, the potential for a significant seismic event that would trigger liquefaction in this area is considered low.

No Prime Farmland has been identified within the salt works; therefore, the completion of nesting enhancements would not adversely affect agricultural resources.

Public Use

No adverse effects to geology, soils, or agricultural resources are anticipated, as no changes in existing conditions would result from the implementation of this alternative.

4.2.2.2.3 Effects to Hydrology and Water Quality

Habitat and Wildlife Management

The removal of invasive plants, particularly through mechanical removal, could expose small areas of soil to wind and water erosion. The result could be a small, temporary increase in sedimentation within the river channel. Such effects would be minimal due to the limited area to be impacted and the limited time that the soil would be unvegetated. Significant adverse effects related to water quality are therefore not anticipated. Additionally, the minor landform alterations associated with invasive plant removal along the river channel would have not adversely affect the existing hydrologic conditions within the Refuge Unit or the surrounding area.

The use of herbicides to control invasive plants could adversely affect the environment as a result of pesticide drift, volatilization, persistence in the environment, water contamination, and harmful effects to wildlife (*Bossard et al. 2000*). The potential for such risks is considered low due to the types and limited quantities of herbicides to be used and the precautionary measures to be taken during application.

Habitat Enhancement

The activities associated with these enhancements would be confined to the interior of the salt works; therefore, no impacts to the surrounding water quality or the hydrological

characteristics of the floodplain are anticipated. Large portions of the Refuge Unit and many of the adjacent properties would continue to be subject to flooding and the outer levees located along the southern edge of the salt works would continue to be subject to overtopping during significant storm events within the Otay River drainage basin.

Public Use

No changes would occur to the public use program currently implemented on the Refuge; therefore, as in Alternative A, no adverse effects to hydrology or water quality are anticipated. In addition, solar salt production would continue in essentially the same configuration as described for Alternative A, therefore, no adverse effects to hydrology or water quality would result from the continued operation of the salt works.

4.2.2.2.4 Effects to Air Quality

Habitat and Wildlife Management

The removal of invasive plants, particularly through mechanical removal, could expose small areas of soil to wind erosion; however, the contribution of particulate matter into the air from this activity would be minimal. No significant adverse effects related to air quality are therefore anticipated. Additionally, because invasive plant control would be implemented for only a few weeks out of the year, no significant adverse impacts related to air quality are anticipated.

Habitat Enhancement

As previously stated, specific criteria for assessing air quality impacts related to land excavation activities have not been established by the APCD; however, Rule 1501of the APCD Rules and Regulations states that a conformity determination is required for each pollutant where the total direct and indirect emissions caused by a Federal action would equal or exceed acceptable rates.

The construction activity required to implement the proposed enhancement projects would involve importing 300,000 to 500,000 cubic yards of fill material and an estimated 65,000 cubic yards of clean sand. This would generate 18,250 to 28,250 truck trips to the site over the life of the project and would require the use of several construction vehicles, such as small dump trucks, skip loaders, and/or small bobcat tractors, to distribute the material throughout the site. The enhancements, which would be completed in a relatively short period of time (some lasting a few weeks, while others not exceeding six months in duration), would result in temporary increases in combustive and fugitive dust (PM_{10}) emissions. The total emissions generated as a result of implementing the proposed enhancements (refer to Attachment H for more detail) would not meet or exceed the rates established for Federal actions by Rule 1501; therefore, the requirements of Rule 1501 would not apply, and no significant direct or indirect air quality impacts would be expected.

Public Use

No adverse effects to air quality are anticipated, as no changes in existing conditions would result from the implementation of this alternative.

4.2.2.2.5 Effects to Noise

Habitat and Wildlife Management

No significant adverse impacts related to noise are anticipated, as the operation of construction equipment to remove invasive plants would occur away from sensitive noise receptors and would be limited to a few weeks each year.

Habitat Enhancement
At present, no residential development or other sensitive noise receptors are located in proximity to the salt pond levees that are being considered for nesting enhancement. In addition, no residential or commercial development is permitted in the area under the adopted land use plans for the area. The City of Chula Vista is currently working on several redevelopment plans for this area that could result in changes to the current land use designations immediately to the east of the salt works. Specifically, the current industrial designation could be changed to a mix of commercial and residential development. If such uses were to be developed prior to implementing the proposed enhancements, mitigation measure could be required to maintain construction generated noise at the eastern edge of the Refuge at or below the maximum level permitted by the adopted city ordinances. Such measures could include: placing restrictions on when and where trucks and other construction vehicles may enter and exit the salt works; specifying staging areas that are well removed from the property line; and, if deemed necessary, identifying locations where the installation of temporary noise barriers would be installed. The implementation of these measures, if deemed necessary at the time of project implementation, would reduce any potential noise impacts to adjacent sensitive receptors to below a level of significance.

Public Use
No changes in current noise levels would result from the uses permitted under this alternative.

4.2.2.3 Alternative C –Enhance and Restore Habitat/Expand Public Uses

4.2.2.3.1 Effects to Topography/Visual Quality

Habitat and Wildlife Management
The effects of implementing the habitat and wildlife management actions proposed under Alternative C would be the same as those described for Alternative B.

Habitat Restoration
Alternative C includes two restoration options for the Otay River floodplain and two for the existing salt pond complex.

Otay River Floodplain Restoration Option 1. Under the first restoration option for the Otay River floodplain, approximately 140 acres of disturbed upland would be converted to 60 acres of salt marsh habitat, 20 acres of freshwater wetland habitat, and 60 acres of native upland habitat (see Figure 2-10). The grading proposed to achieve these habitats would alter the existing landform by widening the Otay River channel within its current configuration to approximately four times its current width. This proposal would also involve the lowering of the northern portion of Pond 20A and an additional area to the south of the Otay River channel by 3 to 12 feet, depending upon the existing elevation and type of salt marsh vegetation desired in a given location. To facilitate restoration of salt marsh and freshwater wetland habitat, approximately 723,000 cubic yards of material would be excavated from the floodplain.

Various options are available for the disposal of this excavated material, including:

- disposal of any clean sand for beneficial uses such as surface enhancement of seabird nesting sites or beach replenishment;
- on-site disposal within the Otay River floodplain;

- on-site disposal within the salt works where material would be needed to achieve proposed nesting enhancements or habitat restoration proposals;
- off-site disposal to an approved development site in need of additional fill material;
- ocean disposal in an approved disposal site, such as LA 5; and
- disposal in an approved landfill.

On-site disposal within the Otay River floodplain could be accomplished by spreading the material over the two areas at the eastern end of the Refuge that are proposed for upland restoration. Assuming all of the excavated material were to be placed within the proposed upland areas, approximately 263,000 cubic yards of the material could be disposed on a 22-acre upland site located to the east of the Otay River and an additional 460,000 cubic yards could be disposed on a 39-acre area located just to the west and south of the river. This proposal would raise the elevation of these upland sites by approximately 8 feet. The 8-foot-high perimeter slopes would be constructed at a relatively gentle 4:1 (horizontal to vertical) slope gradient and would include undulating slopes and varied topographic relief to produce a natural appearing landform. It is likely that some of the excavated material could be used to implement the nesting enhancements also proposed under this alternative, reducing the quantity of material to be disposed of on site (refer to Table 2-11). Further, if restoration of the Otay River floodplain is conducted in association with the restoration of the salt ponds, as discussed below, additional excavated material from the Otay River floodplain could be used to achieve the goals of the salt pond restoration. Under this scenario, the amount of material to be deposited within the proposed native upland restoration area would be reduced.

The landform would also be altered by removing and reconstructing the levee that currently separates Pond 20A from the Otay River channel farther to the south to separate the wetlands within the Refuge Unit from the remainder of Pond 20A, which is owned by the Port.

The grading proposed for this area would result in short term visual impacts resulting from vegetation removal and ongoing grading operations. As the site becomes vegetated, its visual quality would be restored. Currently, I-5 is elevated approximately 12 to 13 feet above the Refuge lands to the west. If fill material is disposed on the proposed upland areas to the west of the freeway, the current topographic relief would be reduced to 4 to 5 feet. Through the incorporation of grading techniques intended to mimic the natural topography in the floodplain, the surface of the disposal areas would appear relatively natural as viewed from the adjacent freeway and the change in elevation would not be readily perceivable from the surrounding public right-of-ways. Views of and through the Refuge would not be adversely affected. The grading required to accommodate the proposed restoration would change the existing landform; however, these changes are not expected to result in any significant adverse effects related to landform or visual quality.

<u>Otay River Floodplain Restoration Option 2</u>. Under the second restoration option for the Otay River floodplain, this area would be graded and recontoured to restore approximately 85 acres of salt marsh habitat, 20 acres of freshwater wetland habitat, and 35 acres of upland habitat. A larger portion of the site would be excavated under this restoration option, generating approximately 970,000 cubic yards of material. On- and off-site disposal options similar to those described above could also be implemented under this proposal. For instance, all or a part of the material could be disposed within the Otay River floodplain on the two designated upland sites. If implemented, this proposal could raise these sites by a minimum of a few inches to a maximum of approximately 18 feet.

Landform modifications would involve excavating much of the area located to the south of the existing Otay River channel, including the northern portion of Pond 20A by 3 to 12 feet. These changes in the landform would be readily apparent as much of the weed-dominated uplands to the west of the freeway would be converted to wetlands supporting small trees and shrubs nearest the freeway and low lying marsh vegetation farther to the west. As with Option 1, some short-term impacts to visual quality would occur during and immediately following excavation; however, once the wetland area is revegetated, the visual quality of the site would be restored and in some cases improved.

The significance of the impact of disposing of excavated material on the two designated upland sites would vary depending upon the amount of material that is placed on these sites. No impacts to views of or across the Refuge are anticipated if the sites are raised from a few inches to a maximum of 8 feet above the existing elevations. Raising the sites from 8 feet to approximately 12 feet above the existing elevations would result in some view obstruction after native upland vegetation is established. Raising the sites from 12 to approximately 18 feet above the existing elevation would block previously open westward views from the freeway. Therefore, disposal options that propose raising the existing elevation of one or both of the designated upland areas by more than 8 feet could adversely affect visual quality, as current views of the floodplain and distance bay from the freeway would be obscured or blocked. This impact would be avoided by reducing the height of the new upland areas to a maximum of eight feet or by ensuring that view corridors through the site are maintained. These measures, which would be incorporated into the final restoration design, would reduce potential impacts to visual quality to below a level of significance.

Salt Works Restoration Option 1. The first restoration option being considered for the salt ponds would involve restoring the three ponds located to the west of the Otay River channel (Ponds 10, 10A, and 11). The existing elevations within some of the ponds would be altered to achieve elevations known to support cordgrass-dominated salt marsh habitat. The desired elevations would be achieved by filling some ponds and recontouring (cutting and filling) other ponds. In addition, the ponds would be breached by cutting a 15-foot or wider opening in the outer levee of each pond to facilitate tidal exchange. The alteration of these existing unnatural landforms (salt ponds and levees) would represent relatively minor topographic changes as viewed from the surrounding area. These overall changes to the western ponds would represent neither an adverse nor a beneficial effect on the existing landform.

The appearance of the western ponds following restoration would be changed from that of water-filled ponds to intertidal mudflats or cordgrass-dominated salt marsh covered by water only during periods of tidal inundation. This change in appearance would be most apparent when viewed from SR-75, the Bayshore Bikeway, and the homes immediately to the south of Pond 10. The views from the residences in the vicinity of Pond 10A already include periods of very low water levels. Therefore, the change from current conditions to a situation in which water levels in the pond are regulated by the tides would be insignificant. The effect to the visual quality and aesthetics as a result of opening Ponds 10 and 11 to tidal action could be viewed as adverse by some observers, while others might consider returning the area to a more historical landscape to be a beneficial visual effect of restoration. Based on the significance criteria for determining when an action would result in a significant adverse visual effect (i.e. an action would substantially alter the natural landform or block public views to a public resource), the Service has determined that the

proposed change in appearance of the ponds would not constitute a significant adverse effect on visual quality.

Salt Works Restoration Option 2. Under this option, all of the primary ponds on both the west and east side of the Otay River (Ponds 10A and Ponds 10 through 15) would be restored to tidal action. As described for Option 1, some alteration of the elevations within the ponds would occur to create elevations appropriate for the desired habitat types, primarily cordgrass-dominated salt marsh and various levees would be breached to facilitate tidal exchange. No significant effects related to landform alternative would result from this proposal.

Similar to the discussion for Option 1, the visual appearance of the primary ponds would change from bodies of open water to unvegetated mudflats and coastal salt marsh habitat alternating with views of open water during high tide. Although there would be a range of opinions regarding the changed appearance of the ponds, as stated for Salt Works Option 1, the Service has determined that this change is not of a sufficient magnitude to constitute a significant adverse effect.

To protect the restored habitat within the eastern salt ponds from damage during a significant flood event, the outer levees of Ponds 20, 22, and 48 would be reinforced under this option. Reinforcement could involve the construction of a stone revetment along the length of the levee. To reduce the visual appearance of this revetment, as viewed from the Bayshore Bikeway, the stone revetment would be covered with geotextile-reinforced soil and vegetated with native vegetation. This measure would reduce the potential for adverse visual effects to below a level of significance.

Public Use

Several public uses proposed under this alternative, including fishing and wildlife observation, would result in minor permanent physical changes to various areas within the Refuge, primarily the northern levee of Pond 11. These changes would involve some grading and resurfacing of the levee to improve accessibility; recontouring of the levee slopes to provide designated areas for shoreline fishing access; and construction of a viewing platform near the eastern end of the levee. Although these changes would alter the existing character of the levee, no significant adverse effects related to topography, landform alteration, or visual quality are anticipated.

Environmental education and interpretation proposals would involve removal of invasive species, restoration of native vegetation, installation of interpretive elements along the portion of the Bayshore Bikeway that abuts the Refuge boundary, and the possible future development of small interpretive trails along restored habitat areas at the southern edge of the Refuge. None of these proposals are expected to adversely affect visual quality.

Construction of the Otay Valley Regional Trail along the eastern edge of the Otay River floodplain would alter a 10- to 15-foot-wide and 1,000-foot long area to create a relatively level six to eight-foot wide dirt path. This trail would result in only minor impacts to the existing topography and would not be visible from within the Refuge. Therefore, if the trail is constructed, it would not result in any significant adverse effects related to landform or visual quality within the Otay River floodplain.

4.2.2.3.2 Effects to Geology, Soils, and Agricultural Resources

Habitat and Wildlife Management

The effects of implementing the habitat and wildlife management actions proposed under Alternative C would be the same as those described for Alternative B.

Habitat Restoration

Nesting Enhancements. The effects to geology and soils from implementing proposed nesting enhancements would be similar to those addressed in Section 4.2.2.2.2. The only difference would be that under this alternative the margins of the proposed nesting areas would be subject to tidal inundation. During final restoration planning, specific measures and/or design features would be developed to minimize the potential for tidal scouring around these nesting areas, as well as to ensure long-term slope stability at the base of the nesting areas.

Otay River Floodplain Restoration. The Otay River floodplain is overlain by approximately two to three feet of uncompacted fill soils. Below the fill are relatively soft and potentially compressible alluvial/bay deposits (*GEOCON 1986*). These soil characteristics represent a geotechnical constraint that would be considered during final design. Specifically, the placement of soils generated during excavation onto those areas designated for upland restoration could result in settlement beneath the proposed fills of several inches. In addition, prior geotechnical analysis (*GEOCON 1986*) indicates that the low shear strength of the existing soil conditions could adversely affect the long-term stability of fill slopes constructed on this site, as well as the new channel slopes constructed within the Otay River to accommodate channel widening. No structures are proposed for construction in this area; therefore, the adverse effects of the existing soil conditions in this area would be relatively minor and preliminary geotechnical analysis indicates that by creating slopes with a slope gradient of 4:1 or flatter, the potential for slope failure would be minimized (*GEOCON 1986*).

Final grading elevations within some portions of the floodplain are expected to be at or below the groundwater table; therefore, dewatering measures may be required to ensure soil stability during excavation. The presence of groundwater may also affect the Service's ability to immediately reuse excavated soils, as the soils may be too wet to allow for proper compaction. It may be necessary to dry and mix excavated silty/clay soils with sandier deposits prior to disposal, depending upon the intended use. A qualified geologist would review these and other geotechnical issues prior to project implementation.

The grain size and chemical characteristics of the soils to be excavated would be analyzed to determine what disposal options are available for the excess material if it cannot all be accommodated within the proposed upland areas. Depending upon the results of the soils analysis, much of the material could be used to restore specific salt ponds to cordgrass-dominated salt marsh and any sand encountered could be used to enhance existing and/or proposed nesting areas. Other disposal options include use in approved offsite development sites, disposal at an approved offshore disposal site, or disposal in a landfill.

The City of San Diego's Seismic Safety Study (*1995*) indicates that the Otay River floodplain possesses a relatively high liquefaction potential. As no structures are proposed within the Otay River floodplain, the potential for liquefaction should not adversely affect the future habitat restoration area provided all graded slopes are maintained at a slope gradient of 4:1 or flatter (*GEOCON 1986*).

Excavation of the Otay River floodplain to restore coastal wetlands and native upland habitat would irreversibly commit lands identified on the 1998 San Diego County Important Farmlands Map as Prime Farmland (*California Department of Conservation 2000*) to nonagricultural use. Although this area was historically cultivated to produce tomatoes and other truck crops, these lands were taken out of production in the 1980s because it was no longer economically feasible to continue agricultural operations at this location. Considering the limited economic feasibility of farming this area combined with the limited size of the parcel, less than 100 acres, the proposed conversion of these lands to wetland habitat is not considered a significant adverse effect with respect to agricultural resources.

Salt Works Restoration. The geotechnical constraints affecting the proposed restoration of the salt ponds would be similar to those addressed for nesting enhancements (Alternative B). In addition, adding fill to the ponds to achieve elevations intended to support cordgrass-dominant salt marsh habitat could result in some settlement beneath the fill. To determine how much settlement would be expected, further soil and geotechnical analysis would be conducted in association with the development of final restoration plans. According to previous geotechnical investigations, the potential for deep-seated failure of submerged slopes, such as those that would be created when a levee is breached, could be minimized by ensuring that all submerged slopes maintain a slope gradient of 3:1 or flatter (*GEOCON 1985*). During completion of the final restoration design, additional analysis would be conducted to determine the actual slopes gradients required to maintain stability, as well as whether armoring of the levee breaches would be necessary to ensure long-term stability. Based on a preliminary review of the existing soil and geotechnical characteristics of the proposed restoration areas, it appears that adequate measures are available to mitigate any adverse effects related to geology and soils to below a level of significance.

No adverse effects to agricultural resources would occur as a result of implementing the restoration options for the salt works.

Public Use

The existing potential for structural damage as a result of seismic ground shaking or seismically induced liquefaction could adversely affect the proposed boardwalk and observation area on the northern levee of Pond 11 should a large earthquake occur in proximity to the Refuge Unit. The potential for such an event is however considered low. Therefore, no significant adverse effects to the proposed public uses are anticipated as a result of existing conditions related to geology or soils.

Although a regional trail could be constructed along the eastern edge of the Otay River floodplain, no significant adverse effects to the agricultural resources present in this area are anticipated.

4.2.2.3.3 Effects to Hydrology and Water Quality

Habitat and Wildlife Management

The effects of implementing the habitat and wildlife management actions proposed under Alternative C would be the same as those described for Alternative B.

Habitat Restoration

Otay River Floodplain Restoration

To better understand the potential effects of proposed restoration on the existing hydrologic and geomorphic characteristics of the Otay River floodplain, preliminary hydrodynamic modeling was conducted for the various restoration options being evaluated for the Otay River floodplain (*Philip Williams & Associates, Ltd. 2003a*). Using a numerical hydrodynamic model, the hydraulic conditions of the lower Otay River, Nestor Creek and South San Diego Bay were evaluated under existing and proposed future conditions. The complete results of this modeling analysis are presented in Appendix I and summarized below.

Flooding Issues

Otay River Floodplain Restoration Option 1. This option involves widening the existing Otay River channel and significantly expanding the area of both tidal and freshwater wetlands (refer to Figure 2-10). The levee around the northern and eastern perimeter of Pond 20A would be removed and a new levee would be constructed along the southern Refuge boundary. This new levee would tie into the existing levee that extends south from the Refuge boundary along the eastern edge of the pond. According to the modeling results, by moving the levee to the southern Refuge boundary, the conveyance capacity of the Otay River increases, the upstream backwater effects are reduced, and the 100-year flood elevations are lowered by more than one foot in several locations (refer to Figure 4-2, Appendix I for predicted changes in flood levels along the Otay River and Nestor Creek channel). Table 4-1 provides a comparison of water surface elevations under existing and alternative conditions for specific points along the Otay River and Nestor Creek.

Within the Nestor Creek drainage (Point E on Figure 3-5), the flood elevations during a 100-year flood would be reduced by approximately two feet. Flood levels within the Otay River would also be lower in all locations between the I-5 bridge and its confluence with Nestor Creek; however, the flood elevation would be expected to increase as a result of restoration where the river passes under the railroad at the northwest corner of Pond 20A (Point D on Figure 3-5). The predicted flood elevation at this location under existing conditions is 13.0 feet NAVD88, while restoration in accordance with Option 1 would raise the flood elevation to 14.0 feet NAVD88. The current elevation of the railroad bridge is approximately 14.3 feet NAVD88; therefore, the predicted increase in the peak water surface elevation at the railroad bridge could adversely affect the structural integrity of the bridge. To avoid the potential for such adverse effects, the Service would coordinate with the City of San Diego during the development of subsequent detailed engineering/restoration plans for the Otay River floodplain to identify appropriate measures for protecting the integrity of the bridge during a flood event.

Also under this restoration option, the portion of Pond 20A to the south of the Refuge would no longer receive spill over from the Otay River under the modeled 100-year conditions. The significant overtopping of the salt pond levees that would occur under existing conditions would continue under this option; however, the length of time during which overtopping would occur would be reduced.

Table 4-1 Comparison of Peak Water Surface Elevations Under 100-Year Flow Conditions					
Location[1]		Existing Conditions	Restoration Option 1	Restoration Option 2	Restoration Option 2 (Modified)
		Peak Water Surface Elevation (ft – NAVD88)			
Otay River	A. Approximately 1000 feet downstream from the I-5 Bridge	18.8	18.0	18.1	18.0
	B. Where the Otay River meets the salt works levee system	18.2	16.8	16.7	16.6
	C. Confluence of the Otay River and Nestor Creek	17.9	15.9	15.8	15.2
	D. Northwestern edge of Pond 20A	13.0	14.0	14.0	15.0
Nestor Creek	E. 2000 feet upstream of the confluence with the Otay River	18.2	16.9	17.8	17.5

[1] See Figure 3-5 for location points.

Otay River Floodplain Restoration Option 2. This option is similar to Option 1 in that it involves an expansion of tidal wetlands and would relocate the Pond 20A levee to the southern Refuge boundary. Unlike Option 1, this option does not include widening of the existing Otay River channel. Instead, the Otay River channel would remain in its current configuration and additional freshwater wetlands would be created to the east of the Saturn Boulevard right-of-way. This option also proposes a larger tidal prism, as the area to be excavated to support coastal salt marsh habitat would be extended farther to the east (refer to Figure 2-11). The hydraulic impacts of this option are similar to those described for Option 1 (refer to Table 4-1). Although Option 2 includes an expanded tidal wetland, this additional excavation would not significantly change the estimated flood elevations from those predicted for Option 1. Specifically, at the location where the Otay River meets the southern most salt pond levees, predicted water levels for Options 1 and 2 differ by less than 2 inches. This is because the water levels upstream of Pond 20A are more heavily influenced by the backwater effects caused by the hydraulic constrictions of the levees than they are by the lowered floodplain. The potential effects to the railroad bridge that are described for Option 1 would also apply to the implementation of this option.

Restoration Option 2 without a Realigned Levee in Pond 20A (Option 2 Modified). A modified version of Restoration Option 2 was also modeled. Under this version, no levee would be constructed along the southern Refuge boundary in Pond 20A. Instead, grading to accommodate restoration in the northern portion of Pond 20A would daylight (match the existing elevation) at the Refuge's southern property line. This modified option also included a proposal for a shallow pilot channel breach from Nestor Creek into Pond 20A (refer to Figure 4-7 in Appendix I). The modeling results for this proposal indicate that flow capacity in Pond 20A would increase significantly, resulting in decreased upstream flooding. However, the decrease in the flood elevation at the confluence of the Otay River

and Nestor Creek (Point E on Figure 4-2) would not be as low as that predicted for Option 1 and only slightly lower than Option 2 (refer to Table 4-1). Additionally, by removing the Pond 20A levee, the railroad bridge at the northwest corner of Pond 20A (Point D on Figure 4-2) would now function as a natural constriction point for the 100-year discharge, increasing the surface water elevation during the 100-year discharge by 2.2 feet to an elevation of 15 feet NAVD88, 0.7 feet higher than the surface of the existing railroad bridge. The implementation of this option would not only subject the railroad bridge to overtopping, it could also expose the bridge to higher discharge, pressure, and scour conditions *(Philip Williams & Associates 2003a)*. To avoid any damage to the bridge as a result of implementing this modified restoration option, subsequent detailed engineering/restoration plans would identify the specific bridge and channel modifications needed to improve the structural integrity of the bridge and increase the flow capacity within the channel as it passes under the bridge during a flood event. The incorporation of these modifications into the project scope would reduce potential adverse effects to below a level of significance.

Flow Velocity and Channel Scour

The three Otay River floodplain restoration options (Option 1, Option 2, and Option 2 Modified) were also evaluated to determine how each might affect flow velocity and channel scour within the Otay River floodplain during a 100-year flood event. Specific details regarding this analysis are presented in Appendix I (*Philip Williams & Associates 2003a*). The analysis, which focuses on flow velocity and channel scour at the railroad bridge (Point D on Figure 3-5), indicates that all three options would produce some increase in discharge velocity and scour at this point. As presented in Table 4-2, the greatest potential increase in discharge velocity would be expected to occur under Otay River Floodplain Restoration Option 2 Modified, while flow velocity would increase by approximately 45 percent over existing conditions under Options 1 or 2. Velocities upstream of the railroad bridge would be slightly lower than existing conditions under Option 1 and would significantly increase under Option 2 and Option 2 Modified. This information combined with estimates of potential changes in localized scour at the railroad bridge, as described below, was used to evaluate the potential effect of restoration on the structural integrity of the bridge.

Table 4-2
Comparison of Velocity Conditions at the Western Railroad Bridge (Point D on Figure 3-5)

Railroad Bridge Velocity Evaluation (feet/second)	Existing	Option 1	Option 2	Option 2 Modified
Velocity at the bridge	5.8	8.4	8.5	11.2
% change from existing conditions		+44.6%	+46.9%	+92.66%
Velocity upstream of the bridge	4.8	4.4	7.2	8.2
% change from existing conditions		-6.9%	+51.7%	+72.41%

(Source: Philip Williams & Associates 2003a)

Using several methods for computing maximum local scour potential, the average local scour depth at the railroad bridge was computed for each restoration option. The intent of this analysis was to provide a relative comparison of potential scour effects at the railroad

bridge for all options. Based on this analysis, Option 2 and Option 2 Modified would likely result in a ±20 percent increase in localized scour at the railroad bridge over existing conditions, while Option 2 would result in about a 10 percent increase over existing conditions.

Increased flow velocities and associated increases in scour potential at the railroad bridge during storm events could adversely affect the structural integrity of the bridge; however, the bridge could already be at risk based on existing conditions within the floodway. Additional analysis would be required to determine if the estimated increase in scour and flow velocity would exceed the current structural design of the bridge or if the bridge would already be at significant risk under existing conditions. In any case, an increase in scour potential of 20 percent or more over existing conditions would represent a potentially significant adverse effect.

Once detailed restoration plans have been completed for the Otay River floodplain, additional hydrodynamic modeling would be conducted to more precisely evaluate the scour potential, flow velocity, and flood elevation in the vicinity of the railroad bridge as a result of the proposed restoration. If the results of this modeling indicate potential adverse affects to the structural integrity of the bridge, the restoration plan would be modified to incorporate measures required to protect the bridge from project-related damage. The anticipated modifications could include reinforcement of lateral and vertical elements, placement of material to reduce channel bed scour, and implementation of measures to mitigate bank erosion. All proposed modifications to the railroad bridge would require coordination with and approval from the Metropolitan Transit Development Board (MTDB), the owner of the railroad bridge, and the City of San Diego, which is processing plans to construct the Bayshore Bikeway on the existing bridge.

Tidal Hydrodynamics

An evaluation of the expected changes in tidal functions within the Otay River floodplain found that the water level elevation of tidal inundation in the vicinity of both the railroad bridge and the Otay River/Nestor Creek confluence would not be significantly affected by any of the proposed restoration options (*Philip Williams & Associates 2003a*). However, tidal inundation would recede at a slower rate than would occur under existing conditions.

As a result of restoration, the area of tidally influenced habitat would increase by approximately 45 acres over existing conditions under Restoration Option 1 and by approximately 60 acres under Restoration Option 2. Therefore, restoration under either option would substantially increase the tidal prism within the Otay River floodplain. A larger tidal prism would result in increased tidal velocities within the main Otay River channel. Changes in the channel geometry resulting from increased tidal flows are not expected to adversely affect the stability of the railroad bridge or the levees along the river channel; however, additional modeling would be conducted in association with final restoration planning. If potential adverse effects are identified at that time, additional evaluation under NEPA would be implemented.

Water Quality

Restoration of the Otay River floodplain could result in the following significant adverse effects to water quality if appropriate measures are not implemented to avoid and minimize impacts to downstream water bodies, including the river channel and the bay: 1) increased sedimentation during and immediately following grading; 2) generation and release of pollutants from construction equipment; 3) release of soil contaminants into downstream

areas; 4) release of poor quality groundwater into surface waters as a result of dewatering; and 5) alteration of water circulation patterns that substantially inhibit mixing or promote stagnation.

Grading within the Otay River floodplain could result in temporary increases in turbidity within the river channel, particularly under Restoration Option 1. Sediment transport into the river channel could also occur as a result of channel widening and the disposal of excavated material on the upland areas that abut the river channel. To avoid and minimize the introduction of sediments into the river channel, excavation would be limited during the rainy season and appropriate BMPs, to be developed in association with the final restoration design, would be implemented.

As discussed in Section 3.3.8.3, preliminary site assessments of the Otay River floodplain indicate the presence of pesticides within the soil. Therefore, prior to restoration, a sampling plan would be prepared and implemented to characterize the type and extent of contamination present on the site. Any soils identified as containing excessive concentrations of contaminants would be removed from the site or otherwise appropriately remediated prior to or in association with site excavation. This process would avoid the release of any soluble pollutants into runoff waters as a result of grading.

Although no activities are proposed on the construction staging areas that would affect water quality, there is the potential for petroleum products such as hydraulic fluid or oils to be spilled or leaked from the equipment stored in these areas. To ensure the complete containment of such materials within the staging area, all staging areas would be located in stable upland areas and would be surrounded by a temporary berm. The implementation of BMPs would ensure prompt and appropriate response to any spills.

The restoration design for the Otay River floodplain would be evaluated to ensure that site grading and tidal channel design would not impede water circulation within the restored area. The design would also be evaluated to determine how surface elevations within the restored marsh plain could be affected over time as a result of tidal scour or sedimentation. Any measures necessary to ensure proper tidal mixing and water circulation would be incorporated into final restoration plans.

The proposal to restore tidally influenced coastal salt marsh at the terminus of the Otay River and Nestor Creek would have long-term beneficial effects to the bay in the form of improved water quality. Currently, urban runoff flowing in the Otay River and Nestor Creek empties directly into the bay via the existing river channel. Under any of the restoration options for the Otay River floodplain, these flows would be directed through the restored marsh where marsh vegetation would filter and assimilate many of the organics and nutrients commonly found in urban runoff, thereby improving the quality of the water entering the bay from the Otay River drainage basin.

Salt Works Restoration

Flooding Issues

Restoring tidal action and modifying the elevations in the various salt ponds, as proposed in Salt Works Restoration Options 1 and 2, would not alter the upstream flood characteristics of the Otay River. In addition, these changes would have no effect on the existing flood flow characteristics within the Otay River channel and the southern levees would continue to be subject to overtopping during a 10-year or greater storm event (*Phillip Williams & Associates 2003a*).

Depending upon the magnitude of the storm, overtopping of the levees could result in the breaching of an outer levee. Larger storms could also breach one or more of the levees within the interior salt ponds, depending upon the peak discharges at the time of overtopping. The primary concern associated with levee overtopping or levee failure relates to potentially significant adverse effects to restored wetlands as a result of excessive scour and/or sedimentation within the restored ponds. As part of final engineering, an analysis would be conducted to develop slope protection measures to protect the levees from failure and the restored wetlands from serious damage. It is anticipated that the slope protection measures would include one or more of the following: biotechnical bank stabilization (the use of living plant material to reinforce soil and stabilize slopes); stone revetment; geotextile-reinforced soil; and/or concrete armor unit revetment. To provide a conservative assessment of the potential impact from such levee protection, it is assumed that the all of the levees along Ponds 20, 22, and 48 would be protected with a stone revetment that would extend from the top of the levee to an appropriate depth below the channel bottom. Overtopping would still occur; however, the construction of the revetment along this length of the salt ponds would minimize the potential for future levee failure. Implementing this measure would provide benefits to the restored habitat by reducing the potential for substantial damage during a flood event.

Tidal Hydrodynamics

The tidal hydrodynamics of the areas within and adjacent to the salt ponds would also change as a result of breaching the levees, restoring tidal action to the ponds, and modifying the bottom elevations of some ponds. Both Salt Works Restoration Options 1 and 2 would restore tidal action to areas of the South Bay that have been separated from the bay for many decades, slightly increasing the overall tidal prism of the bay.

Under current conditions, the water levels in the salt ponds are controlled almost exclusively by the salt works operator. Once the ponds are breached, changes in the water levels within the ponds would be a function of the tides.

Opening Pond 10A to tidal inundation could subject those properties located to the west of 7th Street, between the bay and Cherry Avenue in Imperial Beach, to flooding during extremely rare high water level events that correspond to high astronomical tides and low atmospheric pressure tides. These properties appear to have been constructed below the highest high tide mark, which in the bay is 7.71 feet NAVD88. The current elevation at the eastern property line of the Refuge ranges from 6.57 feet NAVD88 at the northeastern corner of Pond 10A to 8.70 feet NAVD88 just south of Cherry Avenue. The elevation of the mean higher high water (MHHW) level is 5.09 feet NAVD88. The mobile home park located immediately to the southeast of Pond 10A, where the elevations range from 5.9 feet NAVD88 to 6.4 feet NAVD88 at the Refuge property line, could experience inundation more frequently, as these properties could be inundated during spring higher high water conditions that occur a few times each year. Over time, the frequency of inundation could increase for both areas, as the tidal datum benchmarks available from NOAA for the latest tidal epoch (1983 – 2002) show an increase in the frequency/elevations of MHHW. Inundation of surrounding properties could also occur during high tides as a result of wind-generated waves within the pond. Subjecting these properties to tidal inundation would represent a significant adverse hydrological effect.

To eliminate the potential for flooding of properties located adjacent to the Refuge boundary during extreme high tides, an earthen berm two or three feet above the existing ground level would be constructed at the edge of the Refuge in those locations where

existing elevations warrant protective measures. The specific design of the berm would be developed during the completion of final restoration plans. This measure would reduce the adverse effects related to tidal inundation to below a level of significance.

Based on preliminary topographic data, there appear to be a few locations within the salt works where the top of the levee is a few inches below the elevation of the highest recorded tide in the bay. Therefore, these low levees could be subject to overtopping during those rare events in which extreme high tides occur. Affected levee sections include levees between Ponds 10 and 10A, between Ponds 12 and 14, and at the northeast end of Pond 13. The levee between Ponds 10 and 10A includes a segment of the Bayshore Bikeway; therefore, a small portion of the bikeway could also be subject to inundation during extreme high tides. In association with the completion of final restoration plans, an evaluation of the need to incorporate measures for minimizing the effects of occasional tidal inundation would be coordinated with the agencies responsible for maintaining the bikeway. Other portions of the bikeway outside the Refuge boundary, particularly a segment located near the Sweetwater flood control channel, are currently subject to infrequent tidal inundation and occasionally flooding. Potential measures that could be incorporated into the restoration design to reduce the occurrence of tidal inundation include raising the elevation of the bikeway in those areas subject to inundation and/or providing slope protection along the affected levees to minimize the potential for erosion during extreme high tide events.

Water Quality

The potential effects to water quality as a result of restoring tidal wetlands within the Refuge's salt pond complex would include temporary increases in salinity and turbidity within the southern end of the bay.

Salt Works Restoration Option 1. Prior to breaching, the majority of the water within Ponds 10, 10A, and 11 would be drained into the primary ponds on the east side of the Otay River and each pond would be graded (cut and/or filled) to achieve the desired elevations. Excavation in the ponds would occur after the ponds are drained using a dredge, which would require the ponds to be worked when wet, or using conventional dry land equipment. In either case, the ponds would not be breached until the sediments have settled and are no longer suspended in whatever water remains in the ponds. This would minimize the introduction of sediments into the bay during breaching. Draining the ponds prior to breaching would also minimize the effect of introducing water with increased salinities into the bay. As the volume of water remaining in the ponds upon breaching would be minimal, no significant adverse effects to the water quality within the bay are anticipated as a result of breaching. In addition, because the salinity levels in these ponds are relatively low, ranging from 11 to 40 ppt depending upon the time of year, it is unlikely that precipitated salts or higher salinity levels are present in the pond sediments. Therefore, the introduction of tidal action into these ponds would not be expected to release additional salts into the bay. To avoid any unanticipated effects of pond dredging, the pond sediments would be analyzed for salinity content prior to the completion of final restoration plans. If significant accumulation of salts is identified in the sediments, additional measures would be incorporated into the scope of the project to minimize the effects of increased salinities to the bay environment.

Temporary increases in turbidity within the South Bay could occur as a result of the resuspension of sediments within the ponds during initial breaching. The extent to which this increase in turbidity occurs would be dependent upon the character of the sediments

within the ponds prior to breaching. If the character of the sediments consists of fine silts and clay fraction, there is a greater potential for short-term turbidity increases following initial breaching. Coarser sandy material would be less likely to become resuspended. Field studies were conducted in the late 1990s to document the physical environmental factors in the South San Diego Bay. These studies indicate that the overall characteristics of the sediments within the South Bay are relatively uniform and highly suspendable, with the bottom sediments consisting primarily of clay and a thin surface layer of silt (*Merkel & Associates 2000a*). Assuming the sediment characteristics within the ponds are similar to those within the bay, the potential increase in turbidity following breaching would be expected to be similar to the increases in turbidity experienced in the South Bay as a result of normal tidal action and wave action generated by afternoon winds. Suspended sediments may take several hours to several days to settle depending upon the grain size of the sediments (*Merkel & Associates 2000a*). The effects of this resuspension of sediments would be temporary and would not be expected to result in any significant adverse effects to the overall water quality within the bay.

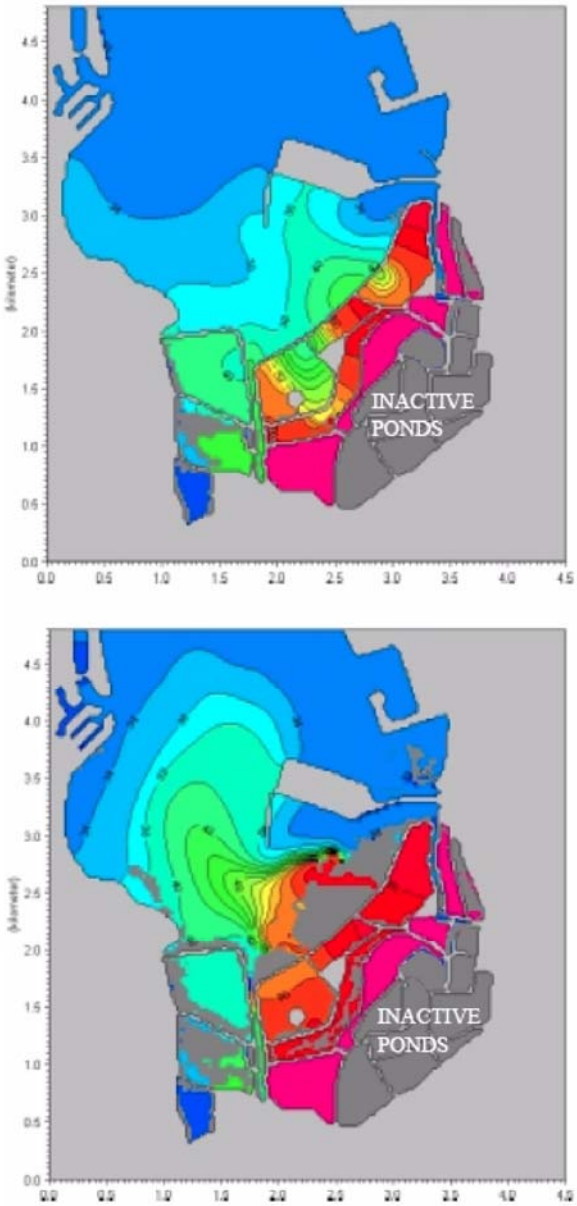
Salt Works Restoration Option 2. Under this option, the western ponds would be breached as described for Option 1 before the remaining primary ponds on the east side of the Otay River (Ponds 12 through 15) are breached. Hydrodynamic and salinity transport modeling was conducted to evaluate the potential effects on salinity levels in the bay of breaching the eastern primary ponds (*Philip Williams & Associates 2003b*). The complete results of this modeling are provided in Appendix I and summarized below.

The contour maps in Figures 4-1, 4-2, and 4-3 present the predicted magnitude and extent (spatial and temporal) of increases in bay salinities following the breaching of Ponds 12, 13, 14, and 15. Specifically, the maps illustrate the depth-averaged instantaneous salinity levels in the bay at selected periods for 1 day, 7 days, and 28 days after breaching both at low and high tides. In Figure 4-4, the salinity levels at various locations in San Diego Bay following breaching are plotted as time series. The plots show that salinity levels are highest near the ponds, reaching 50 ppt during the first ebb tide. These salinity levels drop to the mid 40s one day after breaching and are significantly reduced (below 38 ppt) within seven days as indicated in Figures 4-2 and 4-4.

Within the ponds, the salinity levels drop to below 38 ppt or 5 ppt above ambient levels within seven days. After one month, the levels are expected to be reduced to about 35 ppt. Salinity reduction in Pond 13 would be slightly slower because the pond would not be directly breached to the bay, and would therefore rely on tidal action in Pond 12 for flushing. Under this scenario, the salinity level in Pond 13 would be reduced to 38 ppt after 24 days.

To ensure adequate analysis of the worst-case scenario, the model assumes the ponds are full when breached, however, if the ponds were to be drained farther into the salt works system prior to breaching, the actual effects of pond breaching on bay salinities would be less than predicted by the model. Additionally, the model assumed the ponds would be breached simultaneously. Most likely, pond breaching would be phased over one or two days. This would lessen the initial magnitude of the salinity increases in the bay, although higher than normal salinity levels could persist for a slightly longer, albeit not significant, period of time.

The salt transport model did not take into account the presence of precipitated salts in the ponds, as salinity levels in the sediments are not expected to be significant. Salinity and



Salinity Distribution in South San Diego Bay at *high tide* 1 day after breach.

Salinity Distribution in South San Diego Bay at *low tide* 1 day after breach.

Salinity (psu)
- Above 160
- 100 - 160
- 90 - 100
- 80 - 90
- 70 - 80
- 60 - 70
- 56 - 60
- 54 - 56
- 52 - 54
- 50 - 52
- 48 - 50
- 46 - 48
- 44 - 46
- 42 - 44
- 40 - 42
- 38 - 40
- 36 - 38
- 34 - 36
- 33 - 34
- 32.5 - 33
- Below 32.5

Figure 4-1
South San Diego Bay Salt Ponds
Salinity Distribution in the South Bay & Ponds, Phase 2, 1 Day After Breach

Source: Philip Williams & Associates

Carlsbad Field Office
/stacey/fig_apndx/fig4-1.mxd

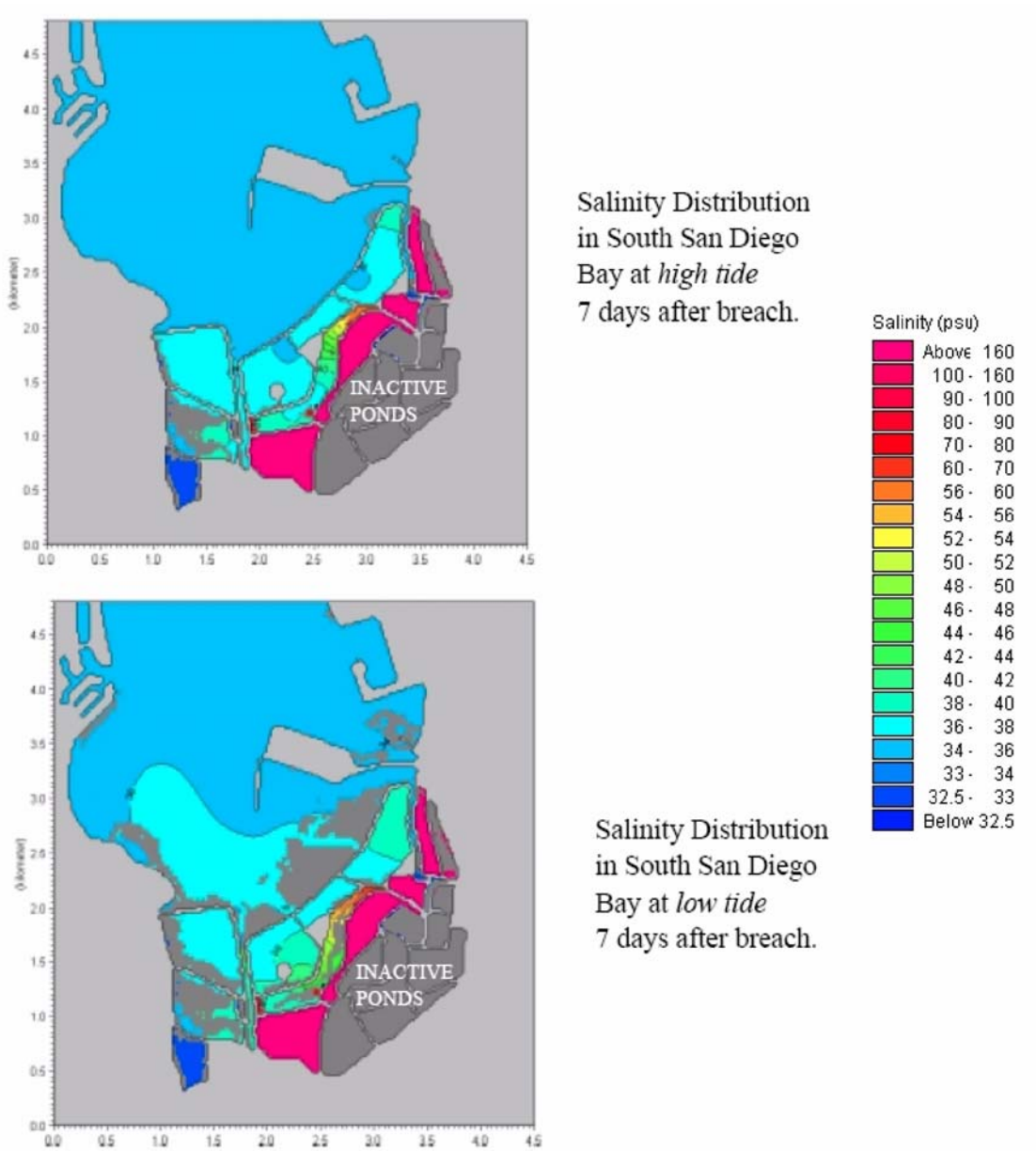


Figure 4-2
South San Diego Bay Salt Ponds
Salinity Distribution in the South Bay & Ponds, Phase 2, 7 Days After Breach

Source: Philip Williams & Associates

Carlsbad Field Office
/stacey/fig_apndx/fig4-2.mxd

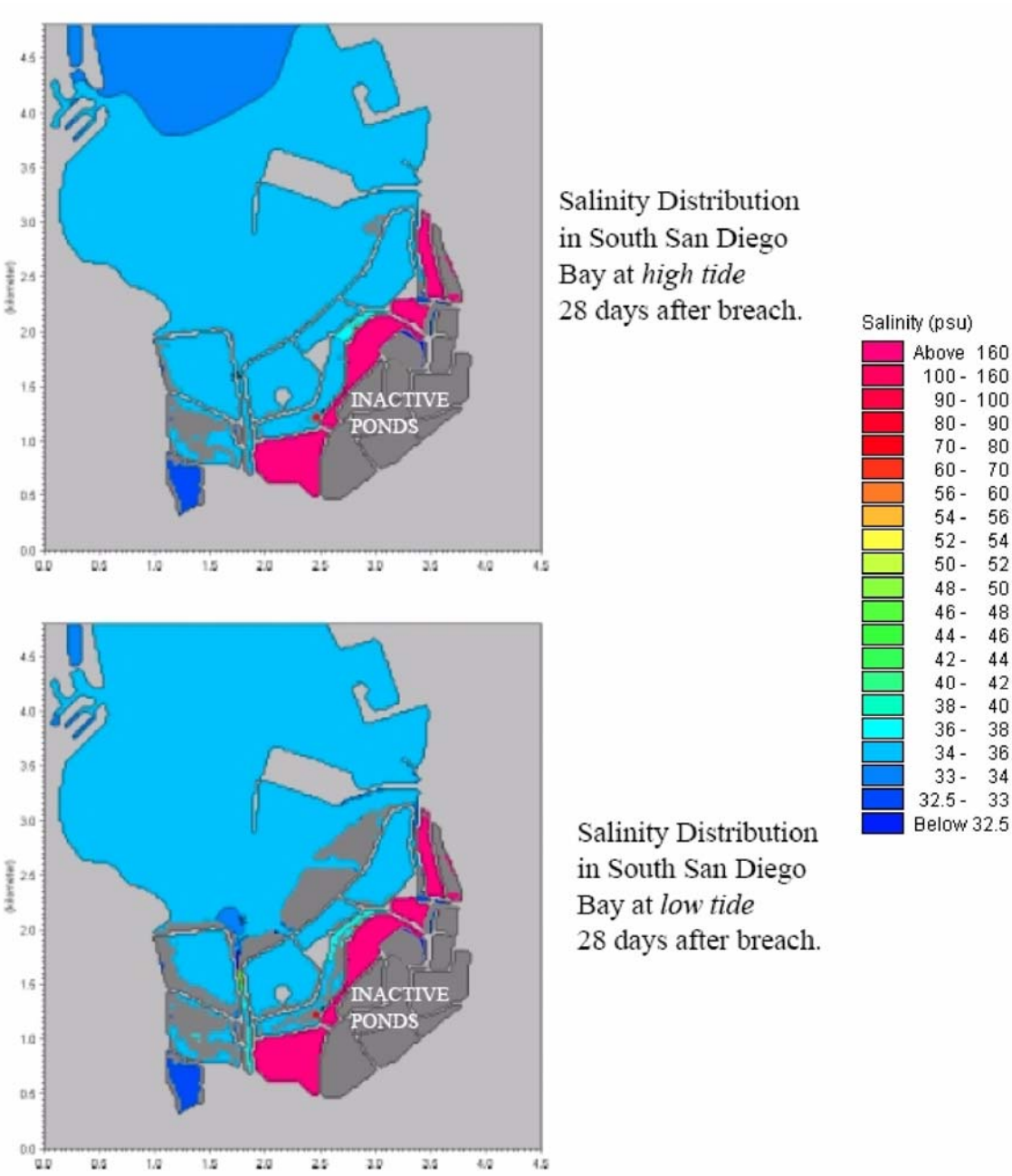


Figure 4-3
South San Diego Bay Salt Ponds
Salinity Distribution in the South Bay & Ponds,
Phase 2, 28 Days After Breach

Source: Philip Williams & Associates

Carlsbad Field Office
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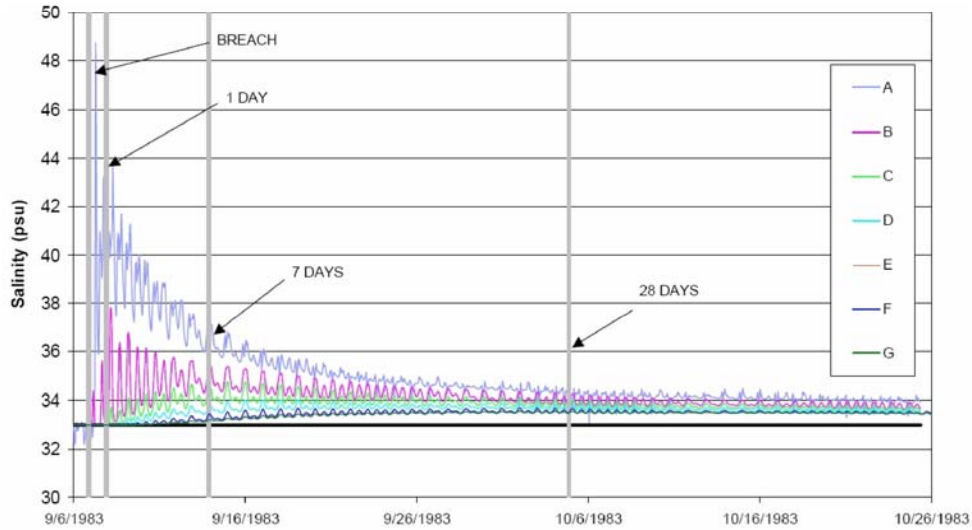


Figure 4-4
South San Diego Bay Salt Ponds
San Diego Bay Salinity Time Series, Phase 2

Source: Philip Williams & Associates

Carlsbad Field Office
/stacey/fig_apndx/fig4-4.mxd

other chemical analysis of the pond sediments has not yet been conducted. Although unlikely, the potential exists for pond sediments to contain elevated salinity levels, metals, organic compounds, and/or excessive nutrients. If present, these elements could be released back into the bay once the ponds are restored to tidal action. Depending upon the type and concentration of such contaminants, if present, pond breaching could adversely affect water quality in the bay. To avoid the potential for such water quality impacts, sediment sampling within the salt ponds would be conducted prior to the completion of final restoration plans. If contaminants are present at levels that warrant remediation, contaminated sediments would be removed or appropriately remediated prior to pond breaching.

Public Use

The minor grading necessary to prepare the northern levee of Pond 11 for public access, as well as the grading associated with the construction of the Otay Valley Regional Trail segment would temporarily expose the soil to water and wind erosion. Such exposure would be minimal and would not represent a significant adverse effect. A potential for some minor long-term erosion problems associated with shoreline fishing access on the northern levee of Pond 11 does exist and would be addressed in a future step-down plan.

4.2.2.3.4 Effects to Air Quality

Habitat and Wildlife Management

The effects of implementing the habitat and wildlife management actions proposed under Alternative C would be the same as those described for Alternative B.

Habitat Restoration

This alternative could be implemented under one of several different scenarios, as described in Section 2.3.2.4. Each scenario would produce temporary increases in combustive and fugitive dust (PM_{10}) emissions, but the total emissions would vary depending upon the amount of excavation and export or import of materials required to implement a given restoration scenario. Emission estimates were prepared to determine if any of the restoration scenarios proposed under this alternative would generate construction-related emissions that exceed the Federal conformity thresholds for criteria pollutants, specifically reactive organic gases (ROG), carbon monoxide (CO), nitrogen oxides (NOx), or particulate matter less than 10 microns in diameter (PM10) (*Jones & Stokes 2004*).

To generate estimates of exhaust emissions and fugitive dust (PM10), the following information was considered: the projected duration of the project; soil import/export estimates (cubic yards of material); estimated truck trips needed to haul material; and estimated of the types and numbers of construction equipment that would be used for individual project phases. Calculations for exhaust emissions also included estimates of off-road construction equipment emissions and emissions from on-road vehicles that would be operated in association with the project, including trucks used to haul material on- and off-site, vendor trips, and worker commute trips. The California Air Resources (ARB) Board's EMFAC2002 model was used to generate estimates for on-road vehicle emission and off-road emission were based on ARB's off-road construction model. A modified version of the road construction emissions model was used to generate estimates of fugitive dust emissions and worker commute trips. The results of these calculations show that the scenarios proposed under this alternative would generate emissions substantially below the Federal conformity thresholds applicable within the San Diego Air Basin (*Jones & Stokes 2004*). Therefore, the requirements of Rule 1501 would not apply, and no significant direct or indirect air quality impacts would be expected. The emissions generated for each scenario are summarized in Appendix H.

Public Use

The uses proposed under Alternative C would not significantly increase existing visitor and recreational activities in the South Bay; therefore, no significant increases in automobile trips that could lead to air quality impacts would be expected.

4.2.2.3.5 Effects to Noise

Habitat and Wildlife Management

The effects of implementing the habitat and wildlife management actions proposed under Alternative C would be the same as those described for Alternative B.

Habitat Restoration

No residential uses or other sensitive noise receptors currently occur in proximity to the eastern portion of the salt works. However, if development of such uses were to occur on adjacent properties prior to restoration, potentially significant adverse noise impacts could occur. Mitigation measures required to reduce such impacts to below a level of significance

would be determined based on the type of uses affected and the projected noise levels at the property line during construction. Mitigation measures that could be implemented include those measures described in Section 4.2.1.3.5. Specific mitigation measures, if deemed necessary, would be determined at the time that final restoration plans are developed.

Residential development does exist to the south of Ponds 10 and 23 and to the east of Pond 10A. In the vicinity of Pond 10A, the mobile homes along the perimeter of the pond would be located approximately 65 feet from the construction boundary, as would the residences located immediately to the south of the Bayshore Bikeway along the eastern half of Pond 10. The other residences located to the east of Pond 10A would be separated from the construction boundary by a distance of 250 to 700 feet depending upon the width of the existing uplands that separate these homes from the pond. The adopted regulations for the City of Imperial prohibit construction noise in excess of 75 dBA at the property line of residential development. Therefore, based on the typical levels of noise generated by construction equipment (refer to Section 4.2.1.3.5) there is the potential for the proposed construction to exceed approved noise levels for several days while excavation occurs in proximity to these homes. To reduce noise levels to below a level of significance, smaller types of construction equipment could be used that generate lower noise levels or an electric hydraulic dredge could be used that generates noise levels in the range of 72 to 75 dBA at 50 feet. Other measures include limiting the number of hours in a day in which construction activity is occurring in the immediate vicinity of residences or installing temporary noise barriers between the homes and the construction area.

The closest residential uses in the vicinity of the Otay River floodplain include a mobile home park located approximately 700 feet to the south of the Refuge boundary. The other use occurring in proximity to the Refuge is commercial development located at the end of 13th Street in Imperial Beach. The separation between the proposed excavation and these uses is great enough that construction generated noise would not exceed adopted noise standards at the property line. No significant adverse noise impacts are therefore anticipated as a result of restoration activities proposed in the Otay River floodplain.

Public Use

The uses proposed would not generate noise levels perceivable to the surrounding areas; therefore, no significant adverse effects related to noise are anticipated.

4.2.2.4 Alternative D – Maximize Habitat Restoration, Moderately Increase Public Use (Preferred Alternative)

4.2.2.4.1 Effects to Topography/Visual Quality

Habitat and Wildlife Management

The effects to site topography and visual quality as a result of implementing the habitat and wildlife management actions included in Alternative D would be the same as those described for Alternative C.

Habitat Restoration

The analysis of potential effects to site topography and visual quality as a result of restoring the Otay River floodplain that is presented for Alternative C would also be applicable under Alternative D.

The topographic and visual effects associated with restoring the salt ponds under Alternative D would be similar to those described in Alternative C, Salt Works Restoration Option 2. The primary difference would be that under Alternative D, additional ponds would be restored to tidal action. The overall topography within the salt pond complex would remain generally unchanged and the open, unobstructed views across the ponds would not be altered. Restoration of the ponds to tidal action would therefore not result in any significant adverse or beneficial effects related to landform alteration. As described in the visual quality impact discussion for Alternative C, converting the existing open water appearance of a majority of the ponds to intertidal areas with fluctuating water levels could be viewed as adverse by some observers. However, as described further in that section, the Service has determined that the changes in the appearance of the ponds, which would reflect the historic conditions of this area prior to human disturbance, would not constitute a significant adverse effect to visual quality.

Reinforcement of the outer levees along Ponds 20, 22, and 48, as described for Alternative C, Salt Works Restoration Option 2, would also be implemented under this alternative. For evaluation purposes, it is assumed that the levees would be reinforced through the construction of a stone revetment. This revetment would be quite visible from the proposed Bayshore Bikeway and potentially other areas to the south. To reduce the unnatural appearance of the revetment, it would be covered with geotextile-reinforced soil and then vegetated with native plants. The implementation of this measure would reduce the potential for adverse visual effects of the revetment to below a level of significance.

Public Use

Of the public uses proposed under this alternative, only the proposal to construct an elevated viewing platform at the north end of 13th Street in Imperial Beach has the potential to adversely affect visual quality. The dimensions and exact location of this structure have not yet been determined; however, impacts to visual quality would be avoided or minimized through proper placement to avoid obstructing views and appropriate structural design to reduce the visibility of the structure from the surrounding area. These measures would be further refined during the development of future step-down plans.

As described in Alternative C, no significant adverse effects to topography or visual quality would result from the construction of the Otay Valley Regional Trail along the eastern boundary of the Refuge, the continued implementation of the Habitat Heroes environmental education program, or the continuation of recreational fishing and boating in the bay. The other wildlife observation and environmental interpretation proposals included under this alternative would involve minor changes in landform and the construction of some structures, such as an elevated boardwalk and viewing platforms along the north side of the Bayshore Bikeway. These proposals would not block any views from the adjacent rights-of-way or substantially alter the current character of the area; therefore, no significant adverse impacts related to topography and visual quality are anticipated.

4.2.2.4.2 Effects to Geology, Soils, and Agricultural Resources

Habitat and Wildlife Management

The effects to geology, soils, and agricultural resources as a result of implementing the habitat and wildlife management actions included in Alternative D would be the same as those described for Alternative C.

Habitat Restoration
The effects related to geology and soils as a result of restoring the Otay River floodplain and the salt ponds under this alternative would be the same as those described for Alternative C. Also, as described for Alternative C, the excavation of the Otay River floodplain would irreversibly commit lands identified on the 1998 San Diego County Important Farmlands Map as Prime Farmland (*California Department of Conservation 2000*) to nonagricultural use. However, because it is no longer economically feasible maintain an agricultural operation in this area, the proposed conversion to wetland habitat is not considered a significant adverse impact with respect to agricultural resources.

No adverse effects to agricultural resources would occur as a result of restoring the salt ponds.

Public Use
No significant adverse effects to geology, soils, and agricultural resources would result from implementing the public uses proposed under Alternative D.

4.2.2.4.3 Effects to Hydrology and Water Quality

Habitat and Wildlife Management
The effects to hydrology and water quality of implementing the habitat and wildlife management actions included in Alternative D would be the same as those described for Alternative C.

Habitat Restoration
The hydraulic changes to the Otay River floodplain and the tidal changes to the salt ponds, particularly in Pond 10A (both described under Alternative C) would also occur under this alternative. The construction of a berm around the southern and eastern edges of Pond 10A, as described in Alternative C, would be implemented to avoid flooding impacts to the surrounding residences during rare episodes of exceptionally high tides.

Flow Velocity and Channel Scour
Managing water levels and salinities within some of the ponds in the existing system would require the circulation of bay water through the ponds. Such a process would involve discharging water from the managed water and managed brine ponds back into the bay. It is anticipated that water from the system would be discharged into the existing drainage channel that flows between Ponds 15 and 28. Depending upon the volume and velocity of the water to be discharged, the channel could be subjected to increased scour during periods of water release. Although some scour could occur, this change in the hydrodynamics of the channel is not expected to adversely affect upstream flow characteristics. Additional evaluation of the effects of discharging water from the brine management area into this channel would be conducted during final restoration planning. Additional NEPA review would be required if any new adverse effects are identified.

Levee Breaching
Under Alternative D, all of the primary ponds, as well as Ponds 23 through 25 and 28 through 30 (the secondary ponds) would be restored to tidal influence. These secondary ponds would be breached once the primary ponds have been breached and the salinity levels in the primary ponds have been reduced to a maximum of 5 ppt above ambient bay levels.

Salinity transport modeling, as described for Alternative C, was also conducted for Alternative D (*Philip Williams & Associates 2003b*). A complete discussion of this modeling effort is presented in Appendix I and summarized below.

The modeling assumptions were similar to those described in Alternative C except the breaches in the outer levees were assumed to have increased to about 30 feet in width as a result of tidal action. Breaches in the secondary ponds were modeled at a width of about 16 feet. The results of the modeling are illustrated in contour maps at selected periods for one day, seven days, and 28 days after breaching both at low and high tides. These contour maps are provided as Figures 4-5, 4-6, and 4-7 and salinities at various locations in San Diego Bay are plotted as time series in Figure 4-8.

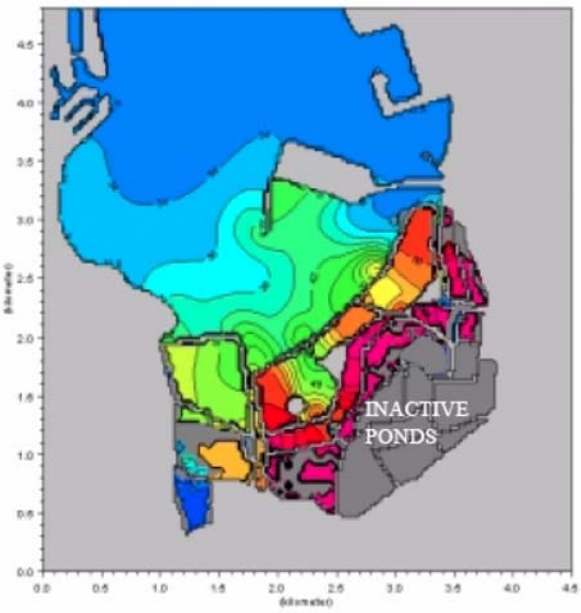
A review of the predicted salinity distribution within the bay indicates that salinities in the vicinity of the ponds peak at 120 ppt during the first ebb tide, then decrease to approximately 60 ppt one day after breaching. The salinities in the breached primary ponds would be even higher and would act to dampen the short-term effects to the bay. Salinities in the immediate vicinity of the ponds would be expected to vary greatly over the tide cycle, with higher salinities observed during the low tide, as hypersaline pond water is discharged into the bay. After seven days, the increase in salinity north of the Chula Vista Wildlife Reserve is less than 5 ppt above ambient levels and numerical results of the model indicate that the potential effects to the bay are negligible after 28 days.

The secondary ponds were modeled assuming no change to the current elevations in the ponds prior to breaching. Based on this assumption, the model indicates that the existing elevations in these ponds are above mean tide level (MTL), with a majority above MHHW. Under these conditions, these ponds would be only partially or rarely tidal. The model indicates that although these ponds would not drain completely due to the topography in the ponds, most of the water would discharge over just six hours, which corresponds to the first ebb tide. Therefore, salinity reduction in these ponds would be very short even under existing topographic conditions.

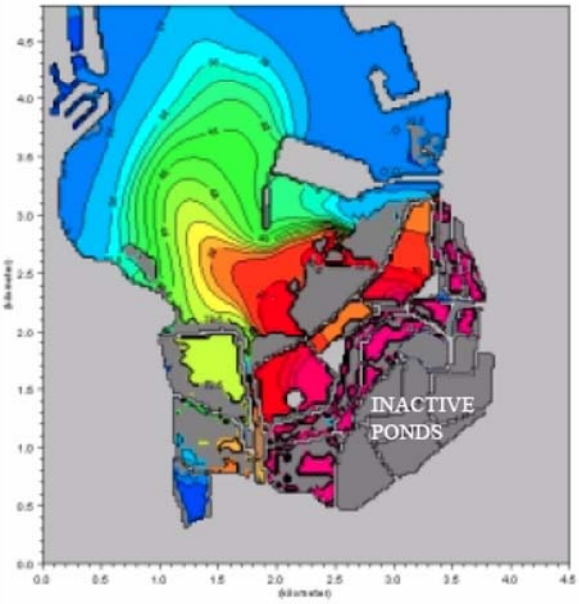
The actual effects of pond breaching on bay salinities could be less than predicted by the model if the secondary ponds are drained farther into the salt works system prior to breaching rather than simply being diluted with bay water upon breaching. The details of levee breaching, including the width and location of the breaches and the phasing of the breaches, would be refined during final restoration design, with the intent of further reducing the effect of breaching on salinity levels within the bay.

The primary salts found in the secondary ponds to be restored to tidal exchange consist of gypsum (calcium sulfate). This substance is relatively inert and is expected to dissolve slowly once subjected to bay water. The presence of a gypsum crust in some of the secondary ponds is not believed to be a water quality issue; however, an analysis of the sediments within the ponds has not yet been conducted. This analysis would be conducted prior to the completion of final restoration plans. The identification of any unanticipated significant adverse effects related to these gypsum deposits would trigger the requirement for additional NEPA analysis prior to the implementation of any restoration.

Should Scenario 3 of Alternative D be implemented, no grading would occur in any of the ponds prior to breaching and all of the ponds would most likely be full upon breaching. The potential effects to water quality within the bay under this scenario would be the same as those predicted above.



Salinity Distribution in South San Diego Bay at *high tide* 1 day after breach.



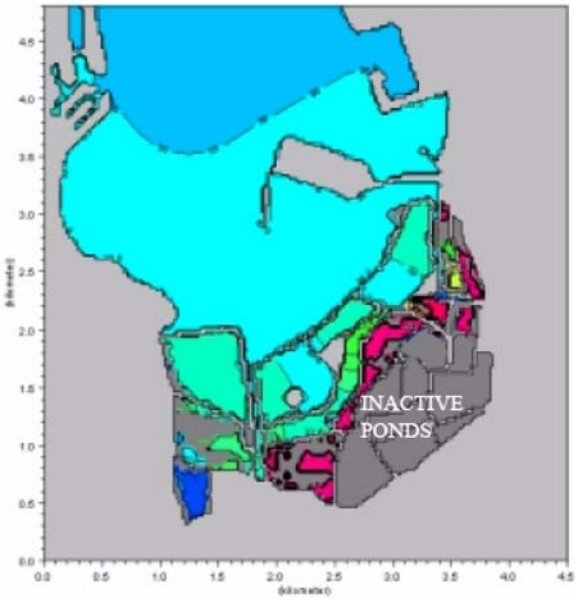
Salinity Distribution in South San Diego Bay at *low tide* 1 day after breach.

Salinity (psu)
Above 160
100 - 160
90 - 100
80 - 90
70 - 80
60 - 70
56 - 60
54 - 56
52 - 54
50 - 52
48 - 50
46 - 48
44 - 46
42 - 44
40 - 42
38 - 40
36 - 38
34 - 36
33 - 34
32.5 - 33
Below 32.5

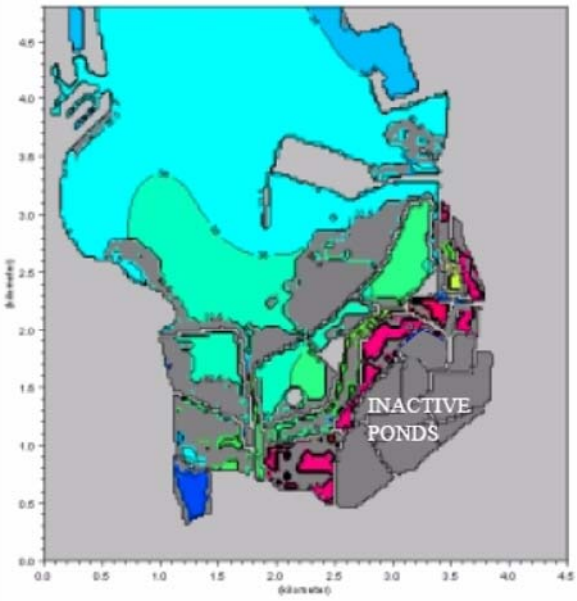
Figure 4-5
South San Diego Bay Salt Ponds
Salinity Distribution in the South Bay & Ponds,
Phase 3, 1 Day After Breach

Source: Philip Williams & Associates

Carlsbad Field Office
/stacey/fig_apndx/fig4-5.mxd



Salinity Distribution in South San Diego Bay at *high tide* 7 days after breach.



Salinity Distribution in South San Diego Bay at *low tide* 7 days after breach.

Salinity (psu)
- Above 160
- 100 - 160
- 90 - 100
- 80 - 90
- 70 - 80
- 60 - 70
- 56 - 60
- 54 - 56
- 52 - 54
- 50 - 52
- 48 - 50
- 46 - 48
- 44 - 46
- 42 - 44
- 40 - 42
- 38 - 40
- 36 - 38
- 34 - 36
- 33 - 34
- 32.5 - 33
- Below 32.5

Figure 4-6
South San Diego Bay Salt Ponds
Salinity Distribution in the South Bay & Ponds,
Phase 3, 7 Days After Breach

Source: Philip Williams & Associates

Carlsbad Field Office
/stacey/fig_apndx/fig4-6.mxd

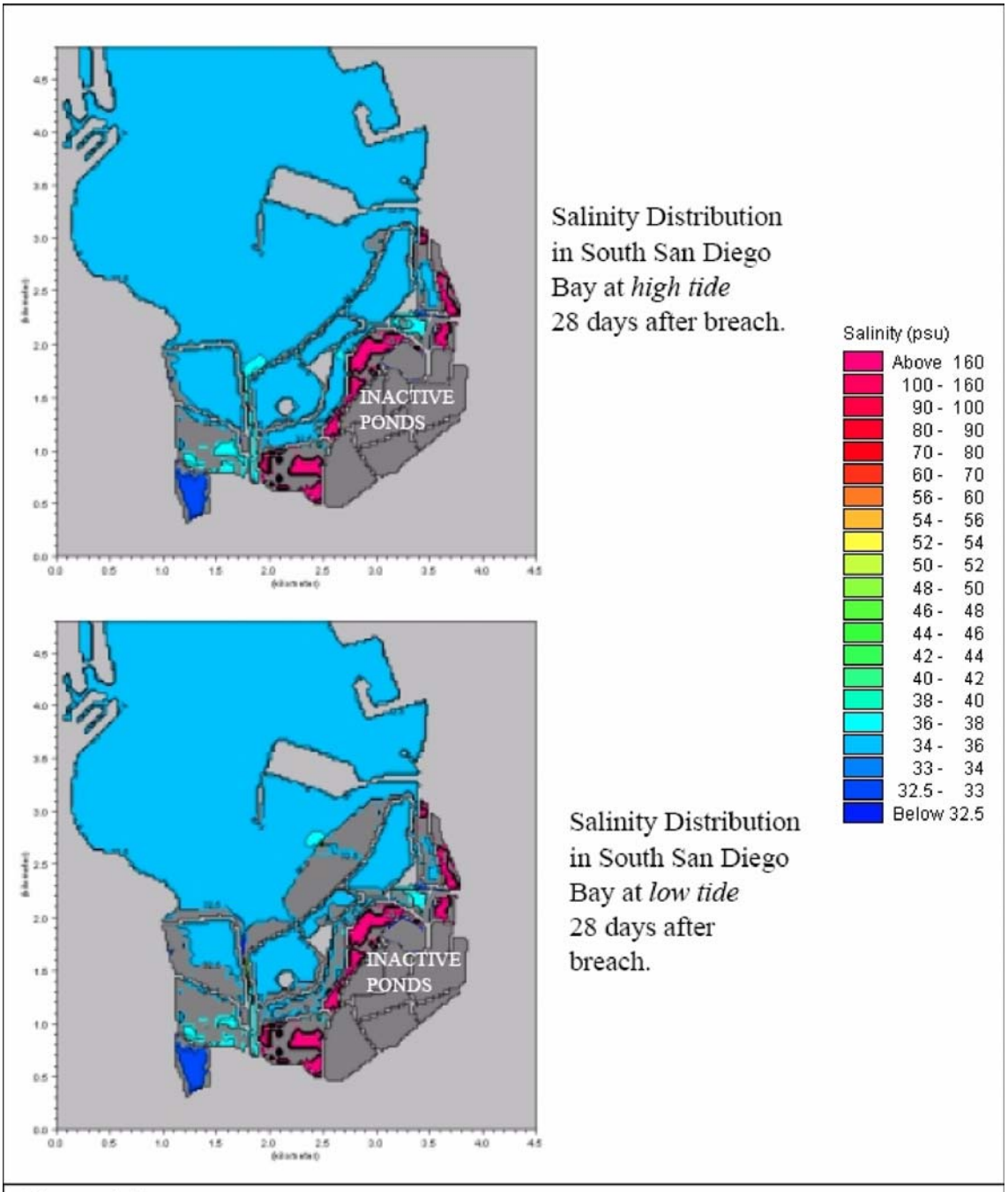


Figure 4-7
South San Diego Bay Salt Ponds
Salinity Distribution in the South Bay & Ponds,
Phase 3, 28 Days After Breach

Source: Philip Williams & Associates

Carlsbad Field Office
/stacey/fig_apndx/fig4-7.mxd

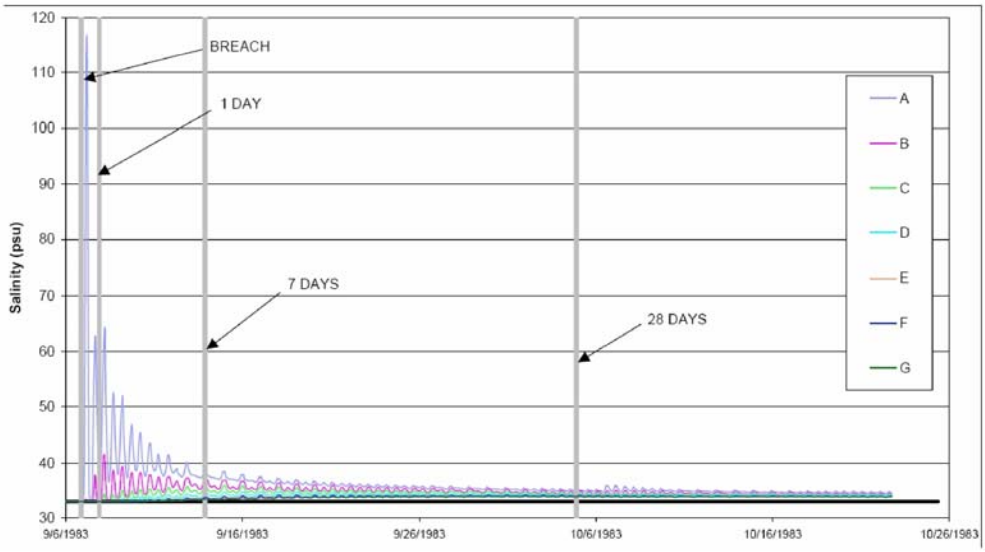


Figure 4-8
South San Diego Bay Salt Ponds
San Diego Bay Salinity Time Series, Phase 3

Source: Philip Williams & Associates

Carlsbad Field Office
/stacey/fig_apndx/fig4-8.mxd

Discharge from the Managed Water Areas

Under Alternative D, all commercial salt production would be eliminated on the Refuge and those ponds that are not breached (Ponds 20 through 22, 26, 27, 41 through 43, and 45 through 48) would be managed to support wildlife. The water levels in Ponds 20 through 22, 26, 27, and 48 (the managed ponds) would be managed throughout the year to create loafing, rafting, and nesting areas for a variety of migratory birds. Ponds 41 through 43 and 45 through 47 (the brine complex) would be managed to produce brine invertebrates for foraging birds. The target salinities in these ponds would range from 80 to 120 ppt to ensure optimum conditions for the production of brine flies and brine shrimp.

Bay water would be pumped into the managed ponds to achieve desired water surface elevations. Depending upon the time of year and the amount of evaporation experienced, the salinities in these managed ponds could approach salinities as high as 40 ppt, 7 ppt higher than ambient bay levels. To avoid adverse impacts to the bay's water quality, when the salinity levels in the managed ponds exceed 5 ppt above ambient bay levels, the water from these ponds would be diluted prior to discharge back into the bay or it would be moved into the brine complex as new bay water is moved into the managed ponds. Similarly, discharge from the brine complex would be diluted to within 5 ppt of ambient bay levels prior to releasing the water back into the bay.

The specific design and operation of the managed water area, including the managed ponds and the brine complex, would be refined during final restoration planning. The feasibility of these systems, particularly the brine complex component, was evaluated as part of the current planning process. The details of this evaluation, which was conducted by Philip Williams & Associates (*2003b*), are presented in Appendix J and summarized below.

The basic components required to implement brine management include a source of seawater inflow to the brine ponds; a source of water, referred to as make-up water, to dilute the brine pond outflow; a mixing basin to combine the brine outflow and make-up water; and a discharge route to the bay. This system assumes that inflow to the brine ponds would be supplied from the managed ponds, as described above. Several ponds within the managed water area would be suitable as mixing basins. These include Ponds 41 and 48, which are located immediately adjacent to the proposed brine ponds. Pond 41 is depicted as the mixing basin in Figure 2-16. The make-up water to be provided to the mixing basin is assumed to come from the bay. This could be supplied from any of the tidal ponds, preferably as far from the eventual brine discharge point as possible. Salinities in the mixing basin would be maintained at no more than 5 ppt above ambient bay levels. The diluted effluent could then be discharged into a drainage canal located to the west of Ponds 41 and 30. From here, the diluted water would be discharged into the bay through the existing drainage channel located between Ponds 15 and 28. If Pond 48 is used as the mixing basin, some grading and levee construction would be required to connect Pond 48 with the canal. Under this scenario, water would be circulated through the managed water ponds and then moved into the brine complex ponds. This system was modeled to determine feasibility, and in particular to estimate how much make-up water would be required to maintain the mixing basin (Pond 41) at 5 ppt above ambient levels. According to the model, the flow rate of make-up water into the mixing basin would peak at about 1,330 gallons per minute (gpm); approximately 900 gpm (68% of the total) would be needed to dilute the brine effluent to discharge levels, and the remaining 420 gpm (32% of the total) would be required to offset the effects of evaporation within the mixing basin. These results suggest that the required pumping rates are feasible, assuming continuous pumping. Discharges to the bay would range between 330 and 1,330 gpm.

Pumping rates could be reduced through the process of flash mixing. This process would involve rapidly diluting the brine outflow in a small basin or canal prior to discharge to the bay. Flash mixing requires smaller flow rates since the effects of evaporation on a small pond surface area are negligible and would reduce peak flows to approximately 800 gpm (from 1,330 gpm). The canal west of Ponds 30 and 41 would provide a possible location for flash mixing.

The results of the modeling analysis suggest that management for brine habitat is feasible from a physical process perspective; however, the model includes several simplifying assumptions for the purpose of preliminary feasibility assessment. To implement the brine management component, these assumptions would be assessed in greater detail in association with the development of final restoration plans. To avoid significant adverse effects to bay water quality, any discharge from this operation would be maintained at or below salinity levels of 5 ppt above ambient bay levels at the time of discharge.

Public Use

The observation areas and interpretive elements proposed along the southern edge of the Refuge would occur in an area overlain by soils characterized as Huerhuero urban land complex (*USDA 1973*). These soils, which occur along the southern bank of the Otay River,

are easily eroded if disturbed. To avoid or minimize erosion and/or sedimentation into the river, the following measures would be incorporated into the design of these facilities: all observation areas and interpretive elements would be sited to maintain a minimum of 25 foot buffer from the edge of the slope; appropriate fencing would be installed along the northern perimeter of viewing areas; all observation and interpretive areas would be graded to direct runoff toward the street and away from adjacent slopes; and materials used to surface these area would be porous and non-erosive. These measures, which would reduce adverse effects to below a level of significance, would be further refined during subsequent step-down planning.

4.2.2.4.4 Effects to Air Quality

Habitat and Wildlife Management

The effects to air quality as a result of implementing the habitat and wildlife management actions included in Alternative D would be the same as those described for Alternative C.

Habitat Restoration

This alternative could be implemented under one of several different scenarios, as described in Chapter 2. Each scenario would produce temporary increases in combustive and fugitive dust (PM_{10}) emissions, but the total emissions would vary depending upon the amount of excavation and export or import of materials required to implement a given restoration scenario. ROG, CO, NOx, and PM10 emission estimates for each scenario are presented in Appendix H (refer to air quality discussion in Section 3.3.7 for more information related to these emission estimates). The estimated emission levels presented in Appendix H show that implementing any of the scenarios presented in this alternative would generate emissions substantially below the federal conformity thresholds applicable within the San Diego Air Basin. Consequently, a conformity determination would not be required and no significant adverse effects to regional air quality would result from restoration under this alternative.

Public Use

New and expanded wildlife-dependent recreational uses would be provided on this Refuge Unit under Alternative D. These expanded opportunities for public use would result in some increases in car and bus trips to and from the Refuge Unit. The majority of these trips would occur during be off-peak traffic hours; therefore, they would not contribute directly or cumulatively to traffic congestion or to the air quality impacts associated with increased traffic congestion. Installation of the proposed public amenities would result in the generation of air emissions during construction, however, the duration of construction would be short and the number of motorized construction vehicles needed to accomplish the work would be minimal. Therefore, air emission from these activities would not meet or exceed the standards established in Rule 1501 of the APCD Rules and Regulations. No significant adverse effects related to air quality are therefore anticipated.

4.2.2.4.5 Effects to Noise

Habitat and Wildlife Management

The effects to noise as a result of implementing the habitat and wildlife management actions included in Alternative D would be the same as those described for Alternative C.

Habitat Restoration
Although this alternative would involve more grading than that proposed under Alternative C, the additional grading would occur far from any sensitive noise receptors. Therefore, the effects of this alternative on ambient noise levels would be similar to those described for Alternative C. The mitigation measures described in Alternative C to reduce excessive noise levels at the Refuge boundary in the vicinity of Pond 10 and 10A would also be implemented under this alternative.

Unlike Alternative C, this alternative would include the use of pumps to move water within the managed water area and to dilute water exiting the managed brine area. The potential for noise impacts from these pumps would depend upon the size and placement of the pumps within the Refuge. To avoid impacts to adjacent uses, pumps would be located a sufficient distance from the Refuge boundary to avoid excessive noise levels at the property line. If it is determined that a pump must be located near an adjacent noise sensitive use, measures such as housing the pump in a noise reducing structure, would be taken to ensure that the noise level at the property line is at or below the approved noise level (per the local jurisdiction's noise ordinance) for the adjacent use.

Public Use
No adverse effects related to noise would result from implementing the various public uses proposed under this alternative.

4.3 Effects to Habitat and Vegetation Resources

The effects to Refuge habitats and vegetation as a result of implementing the various alternatives are described below. Potential impacts to these resources are characterized by evaluating direct, indirect, and cumulative effects. Direct impacts would involve the removal of vegetation as a result of ground-disturbing actions, while indirect impacts would involve changes to habitat or vegetation that are incidental to the implementation of an action. Cumulative impacts to habitat and vegetation resources, described in Section 4.9.2.2, would result when the incremental impact of an action is added to other, closely related past, present, or reasonably foreseeable future actions.

An adverse effect to habitat or vegetation resources would be considered significant if:

- A substantial portion of native habitat would be removed or otherwise modified to accommodate a proposed action.
- An action would result in the direct mortality or habitat loss, lowered reproductive success, or habitat fragmentation of a sensitive or narrow endemic plant species.
- A significant cumulative effect would occur if the loss (adverse effect) or restoration (beneficial effect) of native habitat or a sensitive or narrow endemic plant species as a result of the proposed action is minor but, when considered in light of other similar losses or gains within the region, would be considerable.

A significant beneficial impact would occur if a substantial area of native habitat (an increase of more than 30 percent) is restored or the reproductive success of a sensitive or narrow endemic plant species is substantially increased as a result of improved habitat quality.

4.3.1 Sweetwater Marsh Unit

The effects to habitats, including subtidal, intertidal, coastal salt marsh, and upland habitats, and to native vegetation are described below for each of the three alternatives for the Sweetwater Marsh Unit.

4.3.1.1 Alternative A – No Action

4.3.1.1.1 Effects to Subtidal, Intertidal, Coastal Salt Marsh, and Upland Habitats

Habitat and Wildlife Management

Under Alternative A, no changes to the habitat management activities currently being conducted on this Refuge Unit would occur. As such, no new significant adverse or beneficial effects to the existing habitats on the Refuge would result from the implementation of this alternative. Implementation of the Refuge's Integrated Pest Management Plan, specifically the use of herbicides to control invasive, non-native plants, could adversely impact non-target plants due to pesticide drift, if appropriate application techniques are not employed. However, the potential for adverse effects is expected to be minimal because of the small quantities of herbicide used and the precautionary measures taken during application. Hand weeding, rather than spraying, would be conducted in sensitive habitat areas, such as areas dominated by native salt marsh habitat or in areas that support salt marsh bird's beak and other sensitive plant species. If spraying is proposed in proximity to sensitive habitat areas, the area to be sprayed would first be surveyed for sensitive species and areas to be avoided during spraying would be flagged or otherwise delineated to ensure avoidance of these areas. Hand weeding and limited herbicide spraying would also provide minor benefits to habitat areas by providing opportunities for increased native plant cover. Removal of litter and other debris from the marsh complex could also result in temporary impacts related to trampling of marsh vegetation; however, such impacts would be short-lived and minor and would be offset by the benefits of removing these materials from the marsh. Although no new significant benefits to Refuge resources would be realized under this alternative, the existing habitats would derive some benefit from the control of invasive species; enforcement of Refuge regulations, particularly as they relate to public access; and habitat monitoring.

Restoration of the mitigation leasehold overlays could occur under this alternative, but such restoration is not assured, since it would only occur at the discretion of the leaseholder. The leaseholder or a designated third party would evaluate the environmental consequences of implementing restoration plans for the mitigation leasehold overlays at such time as specific restoration plans are developed for the various overlay sites. Therefore, no analysis of potential impacts for restoration under the current MOU is provided.

Public Use

Under this alternative, the public uses currently permitted on the Refuge (i.e. wildlife observation and photography and environmental education and interpretation) would continue. Therefore, the potential for impacts related to human intrusion into native habitats and trampling of native vegetation would also continue. Although such impacts are minimal, they do occur, particularly in areas on Gunpowder Point where trails end at the edge of salt marsh habitat or lead visitors to the edge of the intertidal mudflats that border the Refuge to the west and south. Post and cable fencing has been installed along the trails, as well as across the ends of the trails, to discourage visitors from entering the adjacent sensitive habitats. Unfortunately, a small number of visitors choose to ignore

signage and fencing, which could ultimately lead to some degradation of the adjacent habitats and/or damage to rare or endangered plants, such as salt marsh bird's beak.

Public access would continue to be restricted to Gunpowder Point, providing benefits to the sensitive habitats and vegetation on the Refuge Unit. Unfortunately, regulatory signage is not always an effective deterrent and unauthorized entrance of people and their dogs occurs in the closed portions of the Refuge Unit. This activity, which can result in habitat and wildlife disturbance, would be expected to continue under this alternative.

4.3.1.2 Alternative B – Habitat Enhancement/Interpretation

4.3.1.2.1 Effects to Subtidal, Intertidal, Coastal Salt Marsh, and Upland Habitats

Habitat and Wildlife Management

Expansion of the current habitat management activities to include a more aggressive invasive plant species control program and the development of a public outreach and education program would provide moderate benefits to the habitat and native vegetation on the Refuge Unit. As described above, although impacts to non-target plants could occur as a result of herbicide application, these impacts are considered minor and the benefits of invasive plant control would be greater. Controlling invasive species within the high marsh and upland transition areas would reduce competition between native plants and the more aggressive weedy, non-native plants. Where native and non-native plants are occurring together, hand weeding or specialized techniques for applying herbicide to nonnative plants would be conducted. As more native plants become established within the upland transition areas, these and other native vegetation in the marsh would benefit from an increased presence of native pollinators, which are essential to the reproduction of several sensitive marsh plant species found on this Refuge Unit.

The public outreach and education program is intended to reduce unauthorized activities on Refuge lands. Sensitive marsh habitat would benefit from a reduction in the incidence of human and dog intrusion into the marsh, as well as the reduction in other unauthorized activities, such as illegal dumping and the release of unwanted domestic animals onto the Refuge Unit.

Habitat Enhancement

This alternative proposes a number of enhancement actions intended to improve tidal circulation within the marsh complex. The implementation of these enhancements could result in the removal of some native vegetation in order to improve conditions for the remaining native habitats on the Refuge. Specifically, this alternative proposes the removal of the abandoned roadbed that traverses a portion of the Sweetwater Marsh and the installation of an additional culvert under the current access road to Gunpowder Point (refer to Figure 2-3). These actions would result in the removal of any vegetation present on the abandoned roadbed and on the slopes of the access road at the site of the new culvert. The vegetation to be affected would include a combination of non-native invasive plants and some native upland/upland transition species. Approximately 7,500 square feet of vegetated and unvegetated area would be impacted at the abandoned roadbed site and less than 3,000 square feet of vegetated slopes would be impacted at the culvert site. Following implementation of the proposed enhancements the impacted areas would be restored to salt marsh habitat.

In addition, temporary impacts to surrounding coastal salt marsh vegetation could occur as a result of construction equipment disturbance and/or trampling by construction crews. To minimize construction related impacts, sensitive habitat areas in proximity to the construction site would be flagged and/or fenced; construction access routes would be selected that avoid or substantially reduce the need for intrusion into the marsh; and small scale, low impact construction equipment would be used whenever possible. Although some native vegetation would be adversely affected, in all cases the losses would be offset by the improved habitat quality within the marsh as a result of increased tidal circulation. For the most part, nonnative or previously revegetated native upland areas would be replaced with new native habitat, primarily low- and mid-marsh habitat. Any adverse effects resulting from the proposed habitat enhancements would therefore be considered well below a level of significance.

These two enhancement proposals would improve the tidal circulation within the eastern portion of the marsh, benefiting more than 20 acres of tidal salt marsh. Improved circulation in this portion of the marsh is expected to result in healthier stands of cordgrass which would provide higher quality foraging and nesting areas for the light-footed clapper rail.

Lowering the levee near the southern tip of Sweetwater Marsh, if deemed feasible, would impact a small area of non-native ornamental and invasive weedy vegetation. Although a few native plants could be lost, the overall adverse effects to the Refuge's native habitat would be minimal and long-term benefits (as described above) to the Refuge's salt marsh habitat from improved tidal circulation would more than offset any adverse effects.

Nesting enhancements proposed for the D Street Fill would occur in proximity to several native coastal dune plant species, including Nuttall's lotus and coast woolly heads. Patches of native salt grass also occur throughout the nesting area. Annual preparation of the site for tern and plover nesting could result in inadvertent damage to some of this vegetation. To reduce the potential for such adverse impacts, those areas supporting a significant population of sensitive plants and/or significant patches of salt grass would be flagged or fenced prior to annual nest site preparation. Refuge staff would review the locations of these areas with contractors prior to commencing enhancement activities and periodic monitoring by Refuge staff would occur. Following the completion of annual disking, flagging and/or temporary fencing would be removed.

Public Use

Effects to Refuge habitats as a result of implementing the public uses proposed under this alternative would be essentially the same as described under Alternative A. The installation of new interpretive elements in the vicinity of Paradise Marsh and F&G Street Marsh would occur within the adjacent public right-of-way and would not adversely affect any native habitats. The interpretive messages provided would provide minor benefits to the adjacent coastal habitats as many members of the public would gain a better understanding of the need to protect the native vegetation within these Refuge areas.

4.3.1.3 Alternative C – Habitat Restoration/Enhance Public Use (Preferred Alternative)

4.3.1.3.1 Effects to Subtidal, Intertidal, Coastal Salt Marsh, and Upland Habitats

Habitat and Wildlife Management

The effects of implementing invasive plant species control in upland transition areas around the marsh complex, as well as on Gunpowder Point, are the same as those addressed under Alternatives A and B. Refuge participation in watershed management planning and local land use planning could benefit Refuge habitats and vegetation if this planning leads to improvements in the quality of the water entering the Refuge from upstream sources.

Habitat Restoration

Restoration of Gunpowder Point would result in the conversion of approximately 25 acres of disturbed uplands, characterized by a mix of native and non-native shrubby vegetation, to coastal sage scrub and maritime succulent scrub habitat. To restore this area, the nonnative vegetation would be removed, while the healthy existing native shrubs that have begun to recolonize Gunpowder Point over the past 20 years would be retained. In those areas where nonnative plants are removed, the site would be revegetated using a combination of native container plants and native plant seeds. In areas where buried plastics are present, it may be necessary to remove all of the vegetation, properly dispose of the plastics, and then revegetate the area with native species. The adverse effects of removing native vegetation would be offset by the restoration of the impacted areas to native habitat.

To avoid any adverse effects to the remnant patches of maritime succulent scrub on Gunpowder Point, these areas would be mapped and flagged and/or fenced prior to restoration in the surrounding areas. Refuge staff would inform any contractors or Refuge crews of the requirements to protect these areas prior to commencement of restoration activities.

Restoration at the D Street Fill under this alternative would involve the conversion of approximately 13 acres of disturbed upland habitat to subtidal, intertidal, and coastal salt marsh habitat. A number of coastal dune plants have colonized this area, including Nuttall's lotus and coast woolly heads, both of which are species of concern. Preliminary restoration plans under this alternative include retaining a strip of upland area along the eastern edge of the fill, where these species have been previously identified. The preservation of this area is intended to minimize adverse effects to these sensitive plant species. Restoration by the Service under this alternative would not occur until after 2010; therefore, the locations and population size of these species may change. An accurate evaluation of potential impacts cannot be made until final restoration plans for this area are developed and a survey of the existing vegetation identifying the location and population size of all sensitive species is completed. Future restoration of this area may require subsequent NEPA analysis to address these site-specific issues.

The alternative also proposes to restore native habitat in the F&G Street Marsh by removing undocumented fill material from the northern portion of the marsh. This action would replace approximately six acres of weedy, non-native vegetation with six acres of native salt marsh habitat. This would represent more than a 30 percent increase in native salt marsh habitat within the F&G Street Marsh, and would therefore be considered a

significant beneficial effect. Temporary impacts to salt marsh habitat could occur during excavation, particularly in those areas that abut the proposed restoration site. These disturbances to existing native vegetation would be minimized by flagging sensitive habitat areas and providing silt barriers during excavation. Refuge staff would also monitor construction activities to ensure compliance with grading restrictions. Any minor unavoidable impacts would be offset by the beneficial effects associated with the overall restoration of the marsh. Such beneficial effects include increased tidal circulation and improved water quality, which in turn would lead to improvements in the health of the plants and generally higher biological productivity within the marsh.

Public Use

The proposal to redesign the existing trail system on Gunpowder Point would benefit Refuge habitats and native vegetation as the new trail system would be designed to reduce the potential for inappropriate off-trail activity. Specifically, trails that currently dead-end at the edge of sensitive habitats, enticing some visitors to travel beyond the trail, would be replaced with loop trails that provide visitors with views of the adjacent habitats, while encouraging them to continue along the path. A revised interpretative plan would also provide opportunities for informing visitors of the importance of the habitats that occur beyond the trail and the need to reduce human disturbance in these areas.

Environmental education programs conducted on this Refuge Unit are not expected to result in any significant adverse effects to native vegetation; however, the program could result in significant long-term benefits to this resource as the public becomes better informed about the sensitivity of the habitats that occur on the Refuge Unit. Some of the refuge-related benefits of environmental education include creating new partnerships with members of the surrounding community, changing public behavior to reduce direct and indirect impacts to wildlife, habitat, and water quality, and increasing the public's awareness of the need to protect sensitive species on site and throughout their range.

4.3.2 South San Diego Bay Unit

The effects to open water, subtidal, intertidal, coastal salt marsh, freshwater wetland, and upland habitats are described below for each of the four alternatives for the South San Diego Bay Unit.

4.3.2.1 Alternative A – No Action

4.3.2.1.1 Effects to Open Water, Subtidal, Intertidal, Coastal Salt Marsh, Freshwater Wetland, and Upland Habitats

Habitat and Wildlife Management

The potential for adverse effects to Refuge habitats and native vegetation from the continuation of current habitat management activities would be minimal. The control of invasive plant species would have effects similar to those addressed in Alternative A for the Sweetwater Marsh Unit and mowing of non-native annual vegetation in the Otay River floodplain would provide minor benefits to native vegetation by reducing biomass and weed seeds in disturbed areas.

Implementation of the habitat enhancements required as part of the Cooperative Agreement would result in a slight increase in intertidal habitat within the Refuge as one of the ponds, possibly Pond 28 or 29, would be breached and restored to tidal influence. This action would provide some benefits related to minor increases in the total acreage of subtidal and intertidal habitats within the Refuge.

Because the ponds do not support any native subtidal or intertidal habitat, the installation of additional pelican platforms within the ponds would not result in any adverse effects to native habitats or vegetation.

Public Use

The continuation of the public uses that currently occur on this Refuge Unit (boating, fishing, and wildlife observation and photography) could result in minor adverse effects to the native habitats. Specifically, adverse effects to open water habitat from the continuation of recreational boating and fishing could occur if motorized boats enter the shallow areas of the South Bay and create damage to the existing eelgrass beds. Another potential impact related to boating and fishing relates to inappropriate landing of motorized and non-motorized boats along the edge of the outer levees of the salt works where disturbance and trampling of intertidal mudflats and salt marsh vegetation could occur. Such impacts would be avoided or minimized by adherence to the "no wake" speed limit established for much of the South Bay and compliance with "closed area" signage within the Refuge.

No adverse effects to Refuge habitats are anticipated as result of continuing to conduct guided nature tours of the salt works outside of the nesting season.

Solar Salt Production

Under current management practices, the solar salt operation maintains the ponds within the system at varying salinities levels. For the most part, the salinity levels in the ponds, particularly in the secondary and crystallizer ponds, are well in excess of average bay salinities. These salinity levels inhibit the growth of native wetland vegetation both within the ponds and on the interior levees of the ponds. The other levees, which abut the bay, do however support patches of high marsh vegetation, including pickleweed, glasswort, alkali heath, and shore grass. Under current conditions, no benefits or adverse effects to adjacent native habitats result from the operation. In addition, because the current operation does not result in any discharge of brine or water into the bay; no adverse effects to the habitats within the bay have been identified. The continuation of current management practices within the salt works would therefore not result in any adverse effects to surrounding habitats.

4.3.2.2 Alternative B –Enhance Nesting Habitat

4.3.2.2.1 Effects to Open Water, Subtidal, Intertidal, Coastal Salt Marsh, Freshwater Wetland, and Upland Habitats

Habitat and Wildlife Management

Potential effects to the native habitats on this Refuge Unit as a result of expanded invasive plant species control would be similar to those addressed in Alternative B for the Sweetwater Marsh Unit. An increased law enforcement presence in the open waters of the Refuge would benefit Refuge habitats by reducing human disturbance in sensitive habitat areas.

Habitat Enhancement

Because little if any native vegetation is supported on the interior levees of the salt ponds, the changes to the levees that are proposed to enhance nesting opportunities would have

no adverse or beneficial effects to native habitat. The outer levees along Pond 11, which do support high marsh vegetation, would not be affected by this proposal.

No subtidal or intertidal habitat is present within the salt ponds due to the existing salinity levels, which exceed typical bay salinities. Therefore, the placement of fill material within the ponds to create additional nesting habitat for terns and plovers would not adversely affect any native vegetation or habitats.

Public Use
Effects to Refuge resources would be the same as described for Alternative A.

Solar Salt Production
Effects to Refuge resources would be the same as described for Alternative A.

4.3.2.3 Alternative C – Enhance and Restore Habitat/Expand Public Uses

4.3.2.3.1 Effects to Open Water, Subtidal, Intertidal, and Coastal Salt Marsh Habitats

Habitat and Wildlife Management
Effects to Refuge resources would be the same as described for Alternative B.

Habitat Restoration
Restoration of the Otay River Floodplain. Restoring the Otay River floodplain in accordance with Restoration Options 1 or 2 could result in temporary, short-term impacts to the intertidal mudflat and coastal salt marsh habitat that extends up the Otay River channel from the bay to approximately 1,500 feet beyond the Nestor Creek confluence. Portions of this existing habitat could be damaged or lost as the area is graded to expand the marsh plain. Under a worst-case scenario, all of the existing habitat would be removed due to construction dewatering and/or grading resulting in a temporary loss of approximately 5.5 acres of intertidal mudflat habitat and coastal salt marsh vegetation. This loss would be more than offset by the restoration of 63 to 88 acres of tidally influenced habitat within this portion of the Refuge Unit. The benefits of restoration, which would be accomplished through a combination of active revegetation and natural recruitment, would include improved biological productivity within existing wetland areas and the reestablishment of the historic landscape in areas changed by human disturbance more than 100 years ago.

Transporting excavated material from the Otay River floodplain to the salt works where the excess soil could be used to enhance nesting areas or to raise the elevation levels within some ponds for the purpose of achieving elevations known to support cordgrass-dominated salt marsh habitat could result in some minor, short-term impacts to native habitat depending upon the access route used to transport the material across the Refuge. A temporary bridge could be placed over the Otay River channel, providing a connection between the Otay River floodplain and the southernmost levee of the salt works resulting in the temporary loss of less than an acre of salt marsh vegetation along the perimeter of the channel. This impact would be offset by revegetating the disturbed areas following construction, as well as by the restoration of a minimum of 60 acres of salt marsh vegetation in the Otay River floodplain.

Salt Pond Restoration. Under Salt Works Restoration Option 1, approximately 200 acres of open water within the pond system with varying salinity levels would be converted to

Salt Pond Restoration. Under Salt Works Restoration Option 1, approximately 200 acres of open water within the pond system with varying salinity levels would be converted to intertidal habitat, while the implementation of Salt Works Restoration Option 2 would convert approximately 440 acres of pond area to intertidal habitat. Restoration would require breaching portions of the pond levees to reintroduce tidal influence into the ponds, however, the majority of the levees would be retained in their current configuration to support historic seabird nesting.

To achieve the desired habitat types in these ponds, it would be necessary to recontour the bottoms of the ponds and in many cases, import fill material into the ponds to raise their elevations. Fill material proposed for placement in the ponds would be analyzed prior to placement to ensure appropriate grain size and soil chemistry for supporting the desired habitat type.

Habitat restoration could occur through natural recruitment or through a combination of natural recruitment and the installation of plant material from appropriate sources elsewhere in the bay. As described in Chapter 3, no subtidal or intertidal habitat is currently supported within the salt ponds; therefore, no adverse effects to native habitat would result from these actions. Further, because so little of the historic coastal wetland vegetation that once occupied the south end of San Diego Bay still exists, the restoration of these ponds to intertidal and subtidal habitat would represent a significant benefit to the bay's ecosystem. This benefit would be greatest under Salt Works Restoration Option 2.

As described in Section 4.2.2.3.3 (Effects to Hydrology and Water Quality), breaching of the ponds under Salt Works Restoration Option 1 would result in a minor, temporary increase in the salinity levels within the bay as the water in the ponds mixes with the bay water after the first low tide. The maximum salinity level within these ponds is approximately 40 ppt; therefore, the increase in salinity levels in the bay following initial mixing with bay water would be less than 40 ppt. Recorded salinity levels in the South Bay generally range from about 34 and 38 ppt, but can be lower when the bay receives freshwater input from winter rains (*Merkel & Associates 2000a*). Because this increase in salinity would only slightly exceed the average salinity level in the bay and this slight elevation in salinity would be short lived, no adverse effects to coastal wetland or marine aquatic habitats are anticipated as a result of opening Ponds 10, 10A, and 11 to tidal influence. To further reduce the effects of breaching, the ponds could be breached in the winter months when bay salinities are naturally lower.

Restoring all of the primary ponds to tidal influence, as proposed under Salt Works Restoration Option 2, would result in higher temporary increases in the salinity levels in the bay immediately following breaching, if the ponds are breached when full. The preferred approach to pond breaching would be to breach the ponds after they have been drained farther into the solar salt system, because the potential for measurable increases in bay salinity would be slight. Under a worst case scenario, the ponds would be full upon breaching. In this scenario, salinities in the bay in proximity to the ponds would peak at 50 ppt during the first ebb tide, then decrease to approximately 40 ppt one day after breaching. Salinity increases above 38 ppt would be limited to the areas south of the Chula Vista Wildlife Reserve and would only occur during the first week following breaching.

Investigations into the effects of salinity on tide pool and subtidal forms of eelgrass occurring in the Izembek Lagoon on the Alaska Peninsula indicate that this species can tolerate a broad range of salinities. Leaf pieces suffered no damage when subjected to salinity levels ranging from distilled water to 93 ppt for up to three days (*Biebl and McRoy 1971*). In addition, respiration is only slightly affected at salinities ranging from 60 to 90 ppt, while photosynthesis decreases in both hypo- and hypersaline seawater (*Biebl and McRoy 1971*). Based on the data, Biebl and McRoy concluded that eelgrass was capable of maintaining a positive net production in salinities ranging from 0 to 56 ppt. The temporary increase (to 50 ppt) in bay salinities that would occur immediately following breaching appear to be well within the observed tolerance range for eelgrass, therefore, no significant adverse effects to the eelgrass beds in the south bay are anticipated under this alternative. Similarly, no impacts to widgeongrass (*Ruppia maritima*), which is also believed to tolerate a broad range of salinities (*Lieberman 2002*), would be expected from these temporary increases in salinity. Various studies conducted to examine responses to salinity variation in marine plants indicate that macroalgae tends to tolerate relatively broad salinity ranges (*Tornasko et al 1999*), although no specific studies have been identified for the species occurring within the South Bay. Based on the limited time (i.e., one week) in which marine plants would be subjected to higher salinity levels and the general tendency for marine plants to tolerate higher salinities, no significant adverse effects to plant life within the bay's open water or intertidal habitats from the proposed restoration plan would be anticipated.

Public Use

Fishing and recreational boating would continue to occur within the bay under this alternative, therefore, the potential effects of these uses on Refuge resources would be the same as those described under Alternative A. Expanded management activities, including the enforcement of Refuge regulations within the open waters of the bay, could reduce the potential for unauthorized activities such as the landing of boats on the outer levees of the salt works, which are closed to public access from the bay.

Disturbance to shorebirds and other migratory birds utilizing the intertidal mudflats located along the outer levees could also occur as a result of human activity associated with guided tours on the salt works and along the northern levee of Pond 11. To ensure that such disturbance is minimized during migration, the effects of human activity in proximity to these areas would be monitored over a period of several years to determine if disturbance is reducing the value of this habitat for migratory birds. If adverse effects are identified, the public uses would be modified to minimize disturbance.

Under this alternative, the northern levee of Pond 11 would be opened for recreational fishing and wildlife observation. Improvements required on the levee to accommodate these uses would necessitate the removal of some of the high salt marsh habitat that occurs along the slopes and edges of the levee top. Additional damage related to trampling of native vegetation could also occur as people attempt to access the edge of the bay. The significance of the impact to coastal salt marsh habitat would depend upon the extent of habitat removal that would be required to prepare this levee for fishing and wildlife observation activities, as well as the measures that are incorporated into the public access plan to minimize impacts to the remaining habitat. Under a worst case scenario, up to four acres of high marsh vegetation could be impacted. Once specific plans are developed for this proposal, additional evaluation of potential impacts would be conducted. Mitigation for any significant loss of high marsh vegetation would be provided through the restoration of this habitat within the Otay River floodplain (refer to Table 4-6 for specific acreages).

This alternative also includes a proposal to construct a boardwalk along the southern edge of the salt works, immediately adjacent to the existing Bayshore Bikeway. The purpose of this boardwalk is to direct human activity away from the cordgrass-dominated salt marsh habitat proposed for Pond 10 and onto the boardwalk. Currently, many walkers choose to avoid conflicts with bicyclists by walking to the north of the bike path along the edge of Pond 10. This has resulted in the loss of vegetation and increased erosion along the edge of the pond. This activity would have even greater impacts once the western ponds are breached and restoration is implemented within the ponds. Removal of standing water in Pond 10 would make access onto the Refuge for people and their dogs much easier. The construction of the boardwalk would reduce accessibility into the pond, while also providing safe access for wildlife observation along the edge of the Refuge. No impacts to existing vegetation would occur as a result of constructing the boardwalk. In addition, increases in disturbance as a result of providing the boardwalk are not anticipated as human activity already occurs in this area in association with the Bayshore Bikeway.

To further reduce the potential for intrusion into sensitive coastal salt marsh habitat from the boardwalk, appropriate signage and fencing, if necessary, would be incorporated into the design of the boardwalk, as well as into the design of other wildlife observation sites proposed under this alternative. These measures would reduce the potential for adverse effects to below a level of significance.

Solar Salt Production

The continuation of solar salt production under a reduced footprint would not impact native habitats within this Refuge Unit.

4.3.2.3.2 Effects to Freshwater Wetland and Upland Habitat

Habitat and Wildlife Management

Effects to Refuge resources would be the same as described for Alternative B.

Habitat Restoration

Restoration of the Otay River floodplain under Restoration Option 1 or Option 2 would involve the widening of the existing Otay River channel and would likely result in the removal of existing native and nonnative freshwater wetland vegetation. Although the grading required for restoration would result in short term adverse impacts to approximately three acres of native vegetation, these impacts would be more than offset by the proposed restoration of the Otay River floodplain. Under Otay Floodplain Restoration Option 1, approximately 10 acres of riparian habitat and six acres of freshwater marsh habitat would be restored, while under Restoration Option 2, approximately five acres of riparian habitat and 12 acres of freshwater marsh habitat would be restored. Restoration of these wetlands would reverse the adverse effects of decades of disturbance within the floodplain, representing a significant long-term benefit to the ecosystem.

Public Use

Trail construction and trail users can produce direct and indirect impacts to native habitats due to unauthorized off trail activities and/or inappropriate trail construction. Off trail activities by humans or dogs can result in habitat disturbance, loss of vegetation due to trampling or vandalism, and compaction of soil, which discourage revegetation by native species. Poor trail construction increases the potential for erosion within and adjacent to the trail, resulting in degraded habitat quality and loss of vegetation. Such disturbance

would favor the establishment of non-native invasive plant species, which could lead to reductions in native plant species abundance and diversity.

To minimize such impacts to Refuge habitats as a result of the development of a portion of the Otay Valley Regional Trail, the future design and alignment of the proposed regional trail would be closely coordinated with the Refuge Manager. Currently the area proposed for the future construction of the regional trail is highly disturbed and dominated by non-native, weedy vegetation. Under these conditions, the impacts of trail construction and trail use on sensitive habitats would be minimal, although unauthorized off trail activity could result in impacts to native wetland vegetation. Once the upland habitats on this Refuge Unit are restored, the potential for impacts to native habitat would increase. Adverse effects to sensitive habitats could be minimized by siting the trail along the perimeter of the Refuge to avoid habitat fragmentation, ensuring that the trail is constructed with appropriate grades and outsloping to reduce the potential for excessive erosion, and requiring the installation of post and cable fencing or other appropriate fencing along the trail to discourage off trail activities by humans and dogs. Monitoring of trail activities by the staff and volunteers of the Otay Valley Regional Park would also reduce the potential for off trail activities and trespass onto Refuge lands.

Solar Salt Production

The continuation of solar salt production within a reduced footprint would have no effects on these habitats.

4.3.2.4 Alternative D – Maximize Habitat Restoration/Moderately Increase Public Use (Preferred Alternative)

4.3.2.4.1 Effects to Open Water, Subtidal, Intertidal, Coastal Salt Marsh, Freshwater Wetland, and Upland Habitats

Habitat and Wildlife Management

Elimination of the commercial solar salt operation could have an indirect adverse effect on Refuge resources related to increased human disturbance. Currently, the operators of the salt works are present on the site throughout the day to deter unauthorized access onto the salt pond levees. Once the operation is eliminated, this presence would be removed, which could result in an increase in unauthorized entry into the area. To minimize this effect, expanded management activities would be implemented under this alternative. These activities would include the installation of fencing around the eastern perimeter of the salt ponds, placement of additional regulatory signage around the perimeter of the Refuge and along the outer levees, and routine visits to the area by Refuge staff. The effectiveness of these measures to reduce unauthorized access would be monitored and evaluated. If these measures are determined to be inadequate, additional measures would be developed and implemented to minimize access and reduce disturbance.

Restored upland and freshwater wetland habitats would benefit from the aggressive control of invasive plant species during native vegetation establishment. Monitoring within the restored salt ponds would also provide important data that could benefit future coastal restoration projects throughout the region.

The proposed managed water ponds within this alternative would provide benefits for marine vegetation provided pond salinities are maintained at or near bay salinities. The brine management ponds would lack most macro algae and salt marsh vegetation, but

would sustain hypersaline phytoplankton and brine tolerant invertebrates. The managed ponds could result in localized adverse impacts to existing marine vegetation in the bay if salinity levels at the discharge point exceed 5 ppt above ambient levels for prolonged periods. To avoid adverse impacts, a water management plan, as described in detail in Section 2.3.2.4, would be prepared in association with the preparation of final restoration plans. This water management plan would establish the operating, maintenance, and monitoring activities and associated costs required to maintain these managed water systems. The data obtained from monitoring during the initial establishment of the managed water areas would provide information necessary to confirm that the system can be operated as proposed or that changes through adaptive management would be necessary to achieve desired habitat objectives.

Habitat Restoration

Under this alternative, approximately 650 acres of existing salt ponds would be restored to intertidal mudflat and salt marsh habitats. As described for Alternative C, the ponds proposed for restoration do not support any native subtidal or intertidal habitat due to the existing hypersaline conditions in the ponds. Therefore, this proposal would not result in any adverse effects to native habitat within the salt ponds. The conversion of many of the salt ponds to native coastal wetland vegetation would however provide significant benefits to the bay ecosystem as a large area of the South Bay would again support the historic subtidal and intertidal habitats that once characterized the south end of San Diego Bay.

Implementing the proposed salt pond restoration would result in short-term impacts to water quality within the bay due to increased salinity levels following pond breaching. As described in Section 4.2.2.4.3 (Effects to Hydrology and Water Quality), the predicted salinity distribution within the bay following initial breaching would result in a maximum salinity of approximately 120 ppt during the first few hours of ebb tide due to mixing with the hypersaline waters within the secondary ponds. Increased salinities would generally be confined to the portion of the bay that extends from the Chula Vista Wildlife Reserve Reserve) south to the salt ponds and would range from about 50 ppt in the area immediately to the west of the Reserve to 120 ppt to the southwest of the Reserve. These salinities would decrease to approximately 60 ppt one day after breaching, to about 50 ppt within seven days, and to below 40 ppt after approximately two weeks. The affected portions of the bay would return to normal salinities in less than a month.

The temporary increase in salinity in the south end of the bay could adversely affect intertidal and subtidal, particularly eelgrass, habitat. In 2003, eelgrass beds were observed stretching from Emory Cove to just north of Pond 11 and just to the north of the intertidal mudflats that border Ponds 12 and 14. Some smaller eelgrass beds were also located near the mouth of the Otay River and to the south of the Chula Vista Wildlife Reserve (refer to Figure 3-8). In a prior survey conducted in 2000, no eelgrass was located in the immediate vicinity of the salt ponds, suggesting that the size and distribution of eelgrass beds within the bay fluctuates seasonally and on a year-to-year basis (*Merkel & Associates 2000a*). Eelgrass can disappear following a rapid loss of leaves from the plants and later reappear in the same location. It is not known if regrowth occurs as a result of seedling recruitment or recovery of surviving rhizomes. The presence of eelgrass in the bay declined significantly from late 1997 through 1998 during an El Niño period, but subsequently recovered to conditions equal to or greater than the conditions that existed prior to the El Niño period (*Merkel & Associates 2000a*).

Studies of the effects of salinity on eelgrass indicate that salinity levels in excess of 93 ppt would result in substantial damage to eelgrass foliage (*Biebl and McRoy 1971*); therefore, if salinities in excess of 93 ppt extend into existing eelgrass beds following the breaching of the secondary ponds, it is likely that vegetative damage to individual plants would occur. Based on the observations of eelgrass distribution in the bay overtime, as described above, it is likely that eelgrass damaged by the introduction of high salinities would be replaced by new growth; therefore, any adverse effects to this resource are expected to be temporary in nature.

The magnitude of the salinity increases experienced in the bay following breaching of the secondary ponds could be reduced by staggering pond breaching over time, rather than breaching them simultaneously. Other measures that could be taken include diluting the ponds with bay water prior to breaching or breaching the ponds after draining much of the brine from the ponds farther into the system by continuing to produce salt. No impacts to eelgrass would be anticipated if the ponds are drained through the salt making process prior to restoring them to tidal action.

Breaching the ponds during periods of freshwater input into the bay from the Otay River would also reduce the maximum salinity levels in the bay following breaching. The actual size, location, and timing of the breaches would be determined during development of the final restoration plans. Any breaching plan would consider the potential effects of breaching on both existing and proposed habitats. If implementation of this alternative occurs in phases, consideration must be given to the potential effects of breaching the secondary ponds on the restored habitat within the previously breached primary ponds.

If the ponds are breached under current hypersaline conditions with no attempts to reduce the salinities prior to breaching, an eelgrass monitoring and mitigation plan would be implemented consistent with the Southern California Eelgrass Mitigation Policy. Adherence to this policy would reduce short term adverse effects to eelgrass habitat to below a level of significance.

The discharge of diluted brine water from the managed brine ponds into the existing drainage channel between Ponds 15 and 28 would increase the salinity levels within this drainage by approximately 5 ppt. In addition, the volume and velocity of water flowing through this channel would likely increase. If these increases are substantial, some loss of intertidal habitat (up to two acres under a worst case scenario) within the channel could occur. The adverse effects resulting from the loss of some of the habitat within this channel would be more than offset by the restoration of approximately 650 acres of intertidal habitat within the salt ponds.

Effects to freshwater wetland and upland habitat would be the same as described for Alternative C.

Public Use

The effects of continued boating and fishing within the open bay would be the same as those described under Alternative A.

Impacts to existing and restored habitat as a result of guided nature tours of the restored salt works would be minimal due to the level of supervision to be provided.

The Habitat Heroes environmental education program would occur in an area located to the northwest of Bayside Elementary School, adjacent to a remnant coastal salt marsh area. Without proper supervision, disturbance to sensitive habitat, such as trampling of vegetation, could occur. Such impacts would be avoided by delineating sensitive habitats with post and cable fencing, or other appropriate fencing, and ensuring adequate supervision of students during educational programs.

Interpretive elements would be placed along an existing public trail in areas where off-trail human activity would be difficult due to topographic relief or where fencing is in place to discourage such activity. The potential for adverse effects to adjacent habitats is therefore considered negligible. The proposal to construct a boardwalk along a portion of the Bayshore Bikeway in the vicinity of Pond 10 would benefit native habitats by directing visitors away from the edge of sensitive wetland areas and onto the boardwalk.

4.4 Effects to Wildlife and Fisheries

The effects to wildlife and fisheries as a result of implementing the various alternatives are described below. Once again, potential impacts to these resources are characterized by evaluating direct, indirect, and cumulative effects. Direct impacts involve the primary effect of implementing an action, such as the flushing of foraging shorebirds as a result of wildlife observation activities. Indirect impacts include habitat modifications that result in a change in abundance or breeding success of a species (or group of species), such as increasing the availability of fish in the vicinity of seabird nesting areas following levee breaching. Cumulative impacts would occur when the incremental direct or indirect impact of an action is added to other related actions that would affect the same species (or group of species), such as the effect of modifying a habitat that provides foraging opportunities for raptors on the Refuge combined with the modification of the same habitat elsewhere in the region.

An effect to wildlife and fisheries would be considered significant if:

- An action would result in a substantial change in the amount or quality of available habitat of a wildlife species. (For wintering waterfowl, migrant and wintering shorebirds, or special status species, a substantial reduction in habitat resulting in a significant adverse impact would be defined as a reduction of 30 percent or more of the available acreage or quality of habitat for these species within the Refuge; a significant beneficial impact would be defined as a 30 percent or greater increase in the quantity or quality of habitat for wintering waterfowl, migrant and wintering shorebirds, or special status species.)

- An action would result in a substantial adverse effect, either directly or through habitat modifications, on any wildlife or fish species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by California Department of Fish and Game (CDFG) or USFWS or any avian species identified as a Bird of Conservation Concern.

- There would be a permanent loss (adverse effect) or gain (beneficial effect) of occupied sensitive species habitat or the direct mortality (adverse effect) of individuals of sensitive species as a result of a proposed action.

- An action would substantially interfere with the movement of any native resident or migratory wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites for longer than two weeks.

- There would be a substantial reduction in the population abundance of fish species inhabiting San Diego Bay as a result of a proposed action.

- An action would substantially change in the availability of habitat for fish.

A significant cumulative impact would result from habitat modifications affecting wildlife and/or fish that would be considered minor for the proposed action but when considered in light of other similar losses within the region would be considerable.

4.4.1 Sweetwater Marsh Unit

4.4.1.1 Alternative A – No Action

4.4.1.1.1 Effects to Waterfowl, Seabirds, Shorebirds, and Other Waterbirds

Habitat and Wildlife Management

Various habitat management activities are currently implemented on the Sweetwater Marsh Unit to support a variety of waterfowl, seabirds, shorebirds, and other waterbirds. Some of these activities include invasive plant removal, litter and debris clean up, and brush management. These actions are generally implemented during the non-breeding season to avoid impacts to nesting birds. Law enforcement is implemented throughout the year to reduce disturbance to avian species due to unauthorized access into the closed portions of the Refuge. These management actions provide direct and indirect benefits to the Refuge's avian population. Therefore, the continuation of these management activities would not adversely affect the foraging, roosting, loafing, or breeding activities of these birds.

Monitoring of California least tern and western snowy plover nesting has been conducted annually on the D Street Fill and would continue provided funding continues to be available for this activity. Various studies have documented lowered reproductive success in nesting colonies subject to monitoring due to the effects of disturbance on adults, chicks, and eggs (*Carney and Sydeman 1999*). To reduce disturbance, monitoring protocols have been established that encourage monitoring to be conducted in the mornings to minimize heat stress to chicks and to identify tracks of potential predators. In addition, least tern colonies are generally only entered once a week, with additional monitoring to record nesting activity, egg and chick counts, and any evidence of predation conducted from behind the monitoring vehicle.

Monitoring can also provide indirect benefits to terns and plovers in the form of assisting in our understanding of how these nesting birds are adversely affected by predators, substrate conditions, and other external factors. This information can then be used to improve management practices in subsequent years. To ensure that monitoring activities are not resulting in excessive disturbance and consequently increased predation of chicks and eggs, the Refuge Manager will periodically review the monitoring protocols to make certain the benefits gained from monitoring are not outweighed by the losses caused by this activity.

Predator management activities implemented on the D Street Fill provide benefits to the federally-listed endangered California least tern and threatened western snowy plover, while potential adversely affecting some individual problem gulls, particularly injured gulls. Although no gulls were removed from the D Street Fill nesting areas between 1999

and 2003, hazing has been implemented to discourage healthy gulls from harassing nesting terns and plovers. This activity would continue as needed under this alternative. Under the proposed Predator Management Plan, gulls could also be live-trapped, or if there is an immediate threat to nesting terns or plovers, problem gulls could be lethally removed. In addition, injured gulls found within the nesting colony would most likely be lethally removed. Western gulls (*Larus occidentalis*), which are known egg predators and have been observed feeding on eggs in the tern colony in the past, would be the species most likely affected by predator management. Other gull species, including the California gull (*Larus californicus*) and Heermann's gull (*Larus heermanni*), could also be subject to control on rare occasions. The control of problem gulls during the breeding season is rare at the D Street Fill and would therefore have little effect on the total population of gulls within the Refuge and would have no effects on overall population levels.

Public Use

The existing trail system on Gunpowder Point provides access to the edge of the bay where expansive mudflats provide foraging habitat during low tides. Off-trail human activity in this area could result in disturbances to foraging migratory birds.

Disturbance to foraging and resting migratory birds, such as long-billed curlew and marbled godwit could also occur in the vicinity of the main access road (Gunpowder Point Drive) that crosses the marsh. This road is utilized by Refuge personnel, Chula Vista Nature Center staff, delivery and maintenance trucks, school buses, the shuttle bus that transports visitors to the Nature Center, and other individuals with business at the Nature Center or Refuge office. The level of disturbance appears to relate to the speed of the vehicles on the roadway, the number of vehicles using the roadway at any one time, and the distance of the birds from the roadway. Refuge staff has noted that the faster the vehicle is traveling, the greater the potential for disturbance (*Collins pers. com 2002*). In addition, the closer the birds are to the roadway, the more likely the birds are to flush. The posted speed limit on this access is 15 mph. Adherence to this speed limit would reduce the level of disturbance within the adjacent marsh. These effects although adverse do not represent a significant adverse effect to these Refuge resources.

4.4.1.1.2 Effects to Land Birds

Habitat and Wildlife Management

Birds of Prey (Raptors). Management activities proposed under this alternative involving invasive plant species removal and debris clean up would have no beneficial or adverse effects on raptor species. Predator management, however, which would be conducted in accordance with the Predator Management Plan presented in Appendix M, could result in the relocation or lethal removal of certain individual problem raptors during the breeding season.

The Final EIS for Endangered Species Management and Protection Plan, Naval Weapons Station – Seal Beach, Seal Beach National Wildlife Refuge (*USFWS and U.S. Navy 1990*) includes a comprehensive analysis of the impacts to avian predators, particularly raptors that could occur as a result of implementing an avian predator management program. The analysis of the effects of predator management on mammalian and avian species that is provided in the EIS for Seal Beach has been incorporated by reference into this CCP/EIS. To summarize the findings of that document, the previous EIS concluded that native raptors would benefit from an increase in prey availability as a result of the control of mammalian predators in areas where endangered species are being protected. Those raptor species requiring management because of conflicts with endangered species would

be impacted by removal of a few problem individuals. The adverse effects of predator control on the local and range-wide population of the affected raptor species were found to be insignificant.

Under the proposed predator management plan, the following raptors would be controlled when they pose a threat to endangered species, as determined by the Refuge Manger, the Refuge Biologist, or a qualified predator control contractor (e.g., USDA APHIS Wildlife Services): American kestrels, barn owl (*Tyto alba*), great horned owl (*Bubo virginianus*), burrowing owl, and red-tailed hawk. Actions affecting northern harriers, peregrine falcons, and short-eared owls would only be taken after consulting with the Refuge Manager. Control of any of these species would only focus on problem predators, which are defined as individuals that belong to species known to prey on terns, plovers, or clapper rails and exhibit hunting behavior in nesting areas. Once an individual problem bird is identified, the most effective, selective, and humane tools available to deter, relocate, or if necessary lethally remove that individual would be implemented. Live captured raptors would be removed from the site and held in a licensed/permitted rehabilitation/holding center until they can be released back into the wild. Release would occur after the endangered species nesting season is completed and an appropriate release site has been approved by the Refuge Manager or Refuge Biologist. Raptors would be banded prior to release.

Past experience indicates that the American kestrel would be the most frequently controlled raptor on the Refuge. The first method to be implemented in the control of kestrels observed at the D Street Fill would be non-lethal removal using pole traps or Balchatri traps. Once trapped, individual birds would be banded and held at a licensed/permitted rehabilitation center until the end of breeding season when they would be released back into the wild. Release could take place in rural areas many miles away from the capture site. Similarly, initial control of individual problem owls, harriers, and hawks would involve the use of pole traps. Trapped birds would be held until the end of the breeding season and then released, generally a good distance from the nesting colony. If an individual is injured during trapping it would be taken to an approved rehabilitation center. If the injury is too extensive, the individual would be euthanized.

Shooting, calling/shooting, and spotlight/shooting of an individual problem predator would be selectively used when all other methods of control including trapping proves to be unsuccessful or when the immediate removal of a predator is necessary to avoid further loss of terns and/or plovers. Between 1999 and 2003, nine northern harriers were lethally removed after the individual birds were observed taking least tern adults and/or chicks. During that same period, one Cooper's hawk, one red-tailed hawk, and 21 kestrels were lethally removed, while 24 kestrels, one great horned owl, and three common barn owls were trapped and sent to Project Wildlife for relocation.

The control of specific raptors on the Refuge during the breeding season, as proposed in the Predator Management Plan, could result in a localized reduction in the number of individuals of these species occurring in south coastal San Diego County. However, the removal of individual problem kestrels from this nesting area would not adversely affect the overall population levels of this species in San Diego County.

The breeding population of northern harriers varies from year to year depending upon rainfall and prey availability. According to the San Diego County Bird Atlas (Unitt 2004), in any given year there appear to be between 25 and 75 pairs of harriers in San Diego

County. The removal of one to two individuals from this Refuge Unit would not represent a significant adverse effect on the total breeding population, however, every effort would be made to avoid the lethal removal of harriers from tern and plover nesting areas within the San Diego NWR Complex to avoid significant adverse cumulative effects to the San Diego County's breeding population of harriers.

Impacts to target avian predator species would be minimized by ensuring that predator management is conducted in a scientifically sound and humane manner. A number of other management activities would also be implemented in an effort to reduce avian predation on nesting species. These activities include minimizing the number of potential perching sites by removing non-native shrubs and unnecessary signs and fence posts and using Nixalite® or other anti-perching material on top of required poles and signs to prevent/reduce use by avian predators. Other anti-predation measures include providing concealment devices for chicks, such as roof tiles, or predator exclusion structures that are placed over active nests.

Other Land Birds. Predator management activities could result in the removal of individual problem land birds, such as common ravens and American crows, from tern and plover nesting areas. Other potentially affected land birds include loggerhead shrikes and European starlings. In addition, some non-target birds could be unintentionally captured in traps set for targeted problem individuals. In most cases, such birds are immediately released at the capture site. Only when serious injuries have been sustained during trapping would non-targeted individuals be euthanized. Between 1999 and 2002, only two non-target species were adversely affected as a result of predator management, a western scrub jay (*Aphelocoma californica*) and a northern mockingbird. The jay was released at the capture site, while the mockingbird was euthanized due to injuries.

Ravens and crows would be lethally removed from nesting areas if repeatedly observed entering or foraging within the nesting site. Between 1999 and 2003, 33 ravens were lethally removed from the Refuge. During that same time period, no crows had to be removed.

Loggerhead shrikes are also known predators of least terns. Individual shrikes observed on nesting sites or within 200 feet of a site on multiple occasions would be targeted for non-lethal removal from the site. Between 1999 and 2002, six shrikes were lethally removed from the Refuge and two were sent to Project Wildlife for relocation. No shrikes were controlled in 2003. Since the 1990s, the population of loggerhead shrikes in coastal San Diego County has declined significantly and even in relatively undisturbed areas the numbers of this species are declining (Unitt 2004). Therefore, the take of loggerhead shrikes as a result of predator management actions on the Refuge could adversely affect this species. The magnitude of the affect would be dependent upon the number of individuals removed in a given year, as well as the cumulative effects of removing offending individuals at other tern and plover nesting sites within coastal San Diego County. To minimize the effect of predator management on this species, predator management protocols would require that loggerhead shrikes can only be lethally removed from the Refuge after all other efforts to trap or otherwise remove the bird from the nesting area have been exhausted and there is documented evidence that the individual has taken a least tern or snowy plover. In addition, the protocols for removing offending shrikes will be reviewed annually to determine if changes are required as a result of the current status of the shrike population in coastal San Diego County and/or the number of individuals removed within the Refuge Complex during the prior nesting season.

European starling, a non-native species that has been documented to peck holes in tern and plover eggs, would also be lethally controlled when caught in cage traps. Between 1999 and 2001, 48 starlings were lethally removed from the D Street Fill. No starlings were removed in 2002 or 2003.

The control of ravens, crows, starlings, and shrikes during the breeding season could result in a localized reduction in the number of these birds within the Refuge lands; however, this reduction would not adversely affect the overall population levels within coastal San Diego County or California.

Management activities, such as the removal of invasive plants, potential perching areas, and litter and debris from around the nesting colony, would be implemented under this alternative to future reduce the need to control land birds during the tern and plover nesting season.

Public Use

The existing uses permitted on this Refuge Unit, particularly wildlife observation activities occurring along the existing interpretive trail, could result in some minor adverse effects to land birds as a result of periodic disturbance. No other adverse or beneficial effects are anticipated.

4.4.1.1.3 Effects to Fish

Habitat and Wildlife Management/Public Use

No adverse or beneficial effects to fish would result from the management actions and public use programs proposed under Alternative A. Short-term adverse impacts and long-term benefits to fish could occur as a result of implementing restoration related to the mitigation leasehold overlays. Additional NEPA review would be provided prior to the commencement of restoration activities related to the mitigation leasehold overlays.

4.4.1.1.4 Effects to Invertebrates, Amphibians and Reptiles

Habitat and Wildlife Management/Public Use

The Refuge operations proposed under this alternative would have limited potential for impacts to invertebrates, amphibians, or reptiles because of the limited area to be affected by such activities. In addition, any beneficial effects to these organisms as a result of habitat management would be minor. There would however be environmental consequences to these organisms if restoration occurs within the mitigation leasehold overlays. Additional NEPA review would be required prior to the commencement of restoration activities related to the mitigation leasehold overlays.

4.4.1.1.5 Effects to Mammals

Habitat and Wildlife Management/Public Use

The majority of the management activities implemented on the Refuge under this alternative would have no beneficial or adverse effects on mammals. Predator management, as described in Appendix M, could however result in the removal of individual mammals from the Refuge for the purpose of protecting the Refuge's endangered and threatened species.

Mammals subject to control under the predator management plan include all non-native mammalian predators observed on the Refuge (including feral dogs and cats). In addition, several native species of mammals that are common in urban and urban interface areas

would also be subject to control, including the California ground squirrel, Virginia opossum, striped skunk, coyote, and gray fox. Non-target mammals that could be affected by predator management activities include rabbits and hares, which when trapped are immediately released near the site of capture or at another suitable location on the Refuge. With the exception of feral dogs and cats, all non-native mammalian predators are lethally removed (live-trapped and euthanized, or on occasion shot by an authorized agent for the Service). Native mammalian predators are lethally removed when they pose a threat to listed species. During the 2002 breeding season, 19 California ground squirrels, four black rats, and a feral cat released to an animal shelter, were removed from the vicinity of the D Street Fill to protect nesting terns. In addition, six Norway rats were lethally removed and four ground squirrels were trapped and released during actions taken to protect the light-footed clapper rail from predation. Between 1999 and 2001, 54 ground squirrels, 12 Norway rats, six coyotes, two gray foxes, two striped skunks, one opossum, and one raccoon were removed from the Refuge during the California least tern and western snowy plover nesting season. No native mammals were removed in 1999 or 2001 in association with the protection of the light-footed clapper rail.

The control of native mammalian predator species on this Refuge during the tern/plover breeding season could result in a localized reduction in the number of coyotes, gray foxes, ground squirrels, striped skunks, and raccoons within the Refuge lands; however, this reduction in the local population would have no effect on the regional or range-wide population of these highly resilient species.

The public uses that would occur on this Refuge Unit would provide no benefits or result in any adverse effects to the Refuge's existing population of mammals.

4.4.1.2 Alternative B – Habitat Enhancement/Interpretation

4.4.1.2.1 Effects to Waterfowl, Seabirds, Shorebirds, Other Waterbirds, and Land Birds

Habitat and Wildlife Management

The management activities proposed under this alternative would provide a range of benefits to a variety of avian species, particularly migrating shorebirds and the light-footed clapper rail. These activities, which would improve habitat quality and/or reduce disturbance, include improving regulatory signage throughout the Refuge; installing fencing where necessary to minimize incidents of trespass; developing and implementing a public outreach program to increase the public's understanding of and adherence to Refuge regulations; and planting appropriate native vegetation within the upland transition areas following invasive species control.

The potential effects to some avian species as a result of implementing predator management would be the same as those described in Alternative A. In addition, the control of non-native vegetation, particularly non-native shrubs in the vicinity of the D Street Fill, would reduce available perching sites for raptors and shrikes, which could in turn reduce depravation of terns and plovers. This could also reduce the number of individual birds subject to predator management.

Habitat Enhancement

The construction associated with the various proposals to improve tidal circulation such as the removal or lowering of the weir at Paradise Marsh could result in short term adverse impacts to avian species due to disturbance. This disturbance would be limited in terms of

duration and scope; therefore, no significant adverse effects to avian species are anticipated. To minimize disturbance during project implementation, all construction activity would be conducted outside of the breeding season and peak migration periods, and where possible, construction activity would be confined to the edges of sensitive habitat areas. Further, to reduce the amount of disturbance occurring within the Refuge at any given time, the implementation of enhancement projects would be staggered.

Removal of the abandoned roadbed within Sweetwater Marsh could disturb avian wetland species, such as clapper rails, egrets, herons, and a variety of shorebirds. This disturbance would be limited both in duration and total area affected. It is not likely that any species would be displaced from the marsh, as there is adequate habitat to the north and south of the proposed enhancement area to accommodate the foraging, loafing, and roosting requirements of affected individuals. To minimize impacts to avian species during the removal of the old roadbed, construction activity would occur primarily within the disturbed footprint of the old roadbed and on the adjacent uplands. All activity would occur outside the breeding season and peak shorebird migration periods. In addition, construction routes and staging areas would be located in disturbed areas away from sensitive marsh habitat and the perimeter of the construction area and access routes would be fenced to avoid inadvertent access into sensitive area.

Installing an additional culvert within the current access road would result in similar short-term impacts to avian marsh species. In addition, some temporary loss of marsh habitat immediately adjacent to the road could occur as a result of construction access requirements, as described in Section 4.3.1.2. Construction would occur outside the breeding season and the peak shorebird migration periods, and any vegetation removed from the slopes of the road would be replaced with appropriate native species following construction.

Removal of the levee at the southern end of the marsh would occur in proximity to the bay and associated intertidal mudflats; therefore, construction activity would be limited during peak migration and during the winter months when black brant are abundant in this portion of the bay. More detailed plans are required for this proposal in order to fully evaluate the potential effect to existing waterbird habitat of removing the berm. It is however assumed that the potential impacts to marsh birds would be similar to those described for the removal of the abandoned roadbed.

Each of these improvements would be expected to improve the habitat quality within the marsh, resulting in long-term benefits to the avian species supported by the marsh complex. Specific benefits include improved habitat for and therefore increased availability of prey species, such as fish and macroinvertebrates, and enhanced vegetative cover within the marsh to support nesting and provide protection from predation.

Improved management, expanded site preparation, and enhancement of the existing nesting substrate, as proposed by this alternative for the D Street Fill, could improve California least tern and western snowy plover reproductive success. Such benefits would contribute to the recovery of these federally-listed species. No significant adverse effects to waterfowl or other seabirds, shorebirds, or waterbirds would occur as a result of enhancing nesting opportunities at the D Street Fill.

Enhancement projects intended to improve tidal circulation would occur adjacent to Belding's savannah sparrow habitat; therefore, the disturbance associated with

construction activity could temporarily displace one or more sparrows during construction. Disturbance would not occur during the nesting season; therefore, adverse effects to this species would be expected to be minimal. No other land birds would be adversely affected by the enhancements proposed under this alternative.

Public Use
Effects to these Refuge resources would be the same as described for Alternative A.

4.4.1.2.2 Effects to Fish

Habitat and Wildlife Management/Public Use
The effects of implementing the habitat and wildlife management activities described under this alternative would be the same as those described for Alternative A and no changes to the current public use program are proposed under this alternative.

Habitat Enhancement
The enhancements to tidal circulation that are proposed under Alternative B could result in minor short term impacts to fish during completion of required grading activities. The types of effects that could occur include decreased visibility for foraging activities; the possible loss of fish eggs, larvae, or juveniles if excavation is required within existing tidal channels, and temporary degradation of water quality as a result of increases in suspended sediments. Most fish would be able to avoid the affected areas during construction. Following completion of the enhancements, moderate benefits to fish would result. Such benefits include expanded opportunities for foraging within the marsh, increased availability of cover from predators for some species of fish, and additional habitat suitable for juvenile fish.

4.4.1.2.3 Effects to Invertebrates

Habitat and Wildlife Management/Public Use
The management activities and public uses proposed under this alternative would provide no new benefits or adverse effects to the Refuge's populations of invertebrates.

Habitat Enhancement
The enhancements to tidal circulation that are proposed under Alternative B could result in limited impacts and/or the direct loss of some marine and estuarine invertebrates in the immediate vicinity of proposed grading activities. These impacts would not adversely affect the Refuge-wide population levels of these organisms and following completion of the enhancements, these organisms would benefit from improved habitat quality due to increased tidal circulation within the salt marsh. No adverse or beneficial effects to terrestrial invertebrates are anticipated as a result of this activity.

Recontouring the steep slope along the southern edge of the D Street Fill in association with proposed nesting enhancement activities could impact a population of mudflat tiger beetles that were previously observed along the fringe of the mudflat and low marsh habitat near the southern end of the D Street Fill. The wandering skipper is another terrestrial invertebrate that could be impacted by vegetation removal associated with nesting enhancements on the D Street Fill. This species is often found in associated with saltgrass, which could be removed during nesting site preparation. To avoid unanticipated impacts to sensitive terrestrial invertebrates, a survey of the area to be impacted by nesting enhancements would be conducted prior to project implementation and if such

species are identified, appropriate measures, such as habitat protection, would be implemented to minimize adverse effects to these species.

4.4.1.2.4 Effects to Amphibians and Reptiles

Habitat and Wildlife Management/Public Use Program

The management activities and public uses proposed under this alternative would provide no new benefits or result in any significant adverse effects to the Refuge's amphibian and reptile populations.

Habitat Enhancement

Construction activity related to the tidal enhancements proposed under this alternative is not expected to adversely effect amphibian and reptile populations supported on the Refuge due to the disturbed nature and limited size of the areas to be altered.

4.4.1.2.5 Effects to Mammals

Habitat and Wildlife Management/Public Use

The effects to mammals of implementing the predator management plan under this alternative would be the same as those described for Alternative A. None of the other management activities or public uses proposed under this alternative would be expected to benefit or adversely affect the mammals that occur on the Refuge.

Habitat Enhancement

Construction activity related to the tidal enhancements proposed under this alternative is not expected to adversely affect native mammal populations on the Refuge.

4.4.1.3 Alternative C –Habitat Restoration/Enhance Public Use (Preferred Alternative)

4.4.1.3.1 Effects to Waterfowl, Seabirds, Shorebirds, Other Waterbirds, and Land Birds

Habitat and Wildlife Management

The potential effects to some avian species as a result of implementing predator management would be the same as those described in Alternative A. Of the other habitat management activities included under Alternative C, those related to developing interagency partnerships to address watershed issues and design guidelines for adjacent development projects would likely benefit the avian species supported by the Refuge's coastal salt marsh habitat. No adverse effects to avian species would result from these activities.

Habitat Restoration

Under this alternative, approximately 13 acres of the D Street Fill are proposed for intertidal mudflat and salt marsh restoration and 33 acres would be retained as uplands to provide nesting habitat for the California least tern and western snowy plover. The 13 acres to be converted to wetland habitat have not historically supported seabird nesting despite past attempts to enhance the site for such purposes. Therefore, no adverse effects to nesting seabirds or plovers are anticipated.

Approximately ten more acres of nesting habitat would be preserved under this alternative than would be preserved under Alternatives A or B. Under Alternatives A and B as much as 23 acres of wetland habitat could be restored at the D Street Fill, while only 23 acres would be retained for nesting habitat. Although Alternative C provides potentially more benefit to nesting seabirds and plovers, it does not irreversibly commit this area to a

particular habitat type. If over time the area is not utilized by nesting seabirds or plovers, it could be considered for restoration to appropriate coastal wetland habitat. However, as currently proposed, this alternative is intended to improve the reproductive success of the California least tern and western snowy plover, providing significant benefits in terms of protected nesting habitat free of direct human disturbance. Significant benefits to western snowy plover chicks would also be realized following completion of proposed improvements in access to important foraging areas located along the edge of adjacent tidal channels in the marsh.

The conversion of approximately 13 acres of the D Street Fill to intertidal habitat would result in temporary disturbances to relatively low numbers of waterfowl, waterbirds, seabirds, and shorebirds that forage and rest within the wetland habitats abutting this portion of the Refuge. Specific details regarding the extent of excavation required to achieve the desired intertidal habitats are not yet available; however, any impacts would be more than offset by the proposed restoration. By avoiding construction during the nesting season, adverse effects to breeding waterfowl, waterbirds, seabirds, and shorebirds would be minimized. The proposal to restore approximately 13 acres of coastal wetland habitats would provide moderate benefits to a variety of migratory birds by expanding the availability of foraging and loafing opportunities within San Diego Bay.

Short-term disturbance impacts similar to those described above would be expected during the restoration of the northern end of the F&G Street Marsh. To reduce impacts, construction activities would be limited to the disturbed portions of the marsh; construction access and staging would occur away from sensitive marsh habitat; and no construction would be permitted during nesting season. Expanded habitat and improved circulation would improve habitat quality within this marsh, representing a moderate benefit the avian species.

On Gunpowder Point, restoration of upland habitat is proposed on approximately 25 acres and an additional two acres of salt marsh restoration is proposed along the northwestern edge of this upland area. The potential for impacts to avian wetland species is limited to minor disturbance associated with restoration activities that take place along the northern and western edges of Gunpowder Point. To minimize short-term impacts to species foraging or loafing in the adjacent salt marsh and intertidal habitat, construction activity would not occur during the breeding season or during peak migration periods. All construction activity would be restricted to the surrounding uplands and construction staging would occur away from sensitive habitat areas.

Birds of prey that forage on the D Street Fill and Gunpowder Point could be temporarily displaced from these areas during restoration. These short-term impacts are not considered adverse as the majority of the birds of prey that forage in these areas, also forage throughout the salt marsh complex. It is therefore unlikely that they would be displaced to areas outside of the Refuge. Following restoration, some of the uplands on the D Street Fill would be converted to salt marsh habitat and the disturbed areas of Gunpowder Point would be converted to upland scrub habitat. These changes are not expected to significantly alter the diversity or numbers of raptors that currently forage on the Refuge.

Other land birds could be permanently displaced from portions of the D Street Fill following restoration. By contrast, species such as the Belding's savannah sparrow would benefit from the proposed restoration both here and at the F&G Street Marsh.

Restoration of native upland habitat on Gunpowder Point would most likely result in some increase in the diversity of land birds observed in this area. Overall, these changes would not represent a significant adverse or beneficial effect to land birds.

Public Use

Although no new uses are proposed under this alternative, the Refuge's current environmental education and interpretation programs would be expanded and opportunities for wildlife observation would be enhanced. To facilitate these expanded programs, the existing trail system on Gunpowder Point would be redesigned and new interpretive elements would be provided along the realigned trail. A key design consideration for the future trail system is the emphasis on loop trails rather than trails that end at the edge of a sensitive habitat area. This redesign is expected to reduce unauthorized off trail activity, which would in turn reduce disturbance related impacts to avian species.

The Service would continue to regulate the speed of travel (a maximum of 15 miles per hour) on the main access road that traverses the marsh. In addition, to further reduce the level of disturbance in the marsh as a result of vehicular traffic on this access road, Refuge staff would work with the Chula Vista Nature Center in an effort to reduce the number of cars and trucks that travel on the main access road, particularly during migration.

4.4.1.3.2 Effects to Fish

Habitat and Wildlife Management

The management activities proposed under this alternative (reversing sediment accumulation trends in the marsh and working with other agencies to address local and regional issues related to improved water quality within the watershed) would provide long term benefits to the fish populations supported within the marsh complex.

Habitat Restoration

Under Alternative C, approximately 15 acres of disturbed uplands would be restored to tidal habitat within the Sweetwater Marsh wetland complex and an additional five to six acres of tidal habitat would be restored at the F&G Street Marsh. Although minor, short-term impacts to fish, as described above, could occur during the excavation of these areas, the resulting additional intertidal habitat would provide long term cumulative benefits for a variety of bay's fish population. These benefits include improved foraging habitat and expanded areas of habitat suitable for fish nurseries.

Public Use

Increasing opportunities for wildlife observation, environmental education, and environmental interpretation on Gunpowder Point would have no direct adverse or beneficial effects on fish populations within the Refuge. Indirect benefits could result from environmental education programs that stress the importance of protecting water quality within the watershed upstream of the marsh complex.

4.4.1.3.3 Effects to Invertebrates

Habitat and Wildlife Management/Public Use

The expanded management activities and public uses proposed under this alternative are not expected to adversely affect the Refuge's invertebrate populations.

Habitat Restoration
The restoration of tidal habitat on approximately 15 acres at the D Street Fill and the restoration of an additional five to six acres of tidal habitat at the F&G Street Marsh, as proposed by this alternative, could result in the loss of some terrestrial invertebrates during project grading. Such losses would be minimal and would not adversely affect overall population levels. Increasing the amount of intertidal habitat within the Refuge would provide long-term moderate benefits to a variety of marine and estuarine invertebrates by increase the area of available habitat and improving tidal circulation, which in turn improves water quality and the increases the availability of nutrients in the water column.

4.4.1.3.4 Effects to Amphibians and Reptiles

Habitat and Wildlife Management/Restoration/Public Use
No significant adverse effects to amphibians or reptiles would result from the implementation of the management activities proposed under this alternative. In addition, construction activity related to habitat restoration and public uses is not expected to adversely affect any amphibian and reptile populations supported on the Refuge.

4.4.1.3.5 Effects to Mammals

Habitat and Wildlife Management/Restoration/Public Use
No effects to the mammalian populations on the Refuge other than those related to predator management, as addressed under Alternative A, would occur as a result of implementing this alternative.

4.4.2 South San Diego Bay Unit

4.4.2.1 Alternative A – No Action

4.4.2.1.1 Effects to Waterfowl, Seabirds, Shorebirds, Other Waterbirds, and Land Birds

Habitat and Wildlife Management
The management activities currently being implemented on the Refuge including invasive plant removal, brush management, and major litter and debris clean up, would continue under this alternative. These actions are generally implemented during the non-breeding season to avoid impacts to nesting birds. Law enforcement is implemented throughout the year to reduce disturbance to avian species due to unauthorized access into the closed portions of the Refuge. These activities provide moderate direct and indirect benefits to the Refuge's avian population and would not adversely affect the foraging, roosting, loafing, or breeding activities of the avian species supported on this Refuge.

Under Alternatives A and B, foraging opportunities for least terns would be expanded by breaching either Pond 28 or 29 to restore tidal influence and improve fish habitat in proximity to historic least tern nesting areas. This proposal would provide moderate direct benefits to foraging terns and indirect benefits to a variety of other migratory birds. No adverse effects to any avian species are anticipated as a result of this action.

Endangered species monitoring, another activity proposed under this alternative, is conducted on the salt pond levees during the nesting season and would continue to result in periodic disturbances to the birds within the nesting colonies. Monitoring protocol results in short visits through the colony to record nesting activity, egg and chick counts, and any evidence of predation. Monitoring is conducted one to three times per week from mid-March through early October, with surveys of potential nesting, foraging, and roosting

areas conducted weekly. Least tern nesting areas are entered weekly, as are peripheral sampling areas of larger nesting colonies of the larger species. To minimize disturbance, additional observations are made from along the perimeter road or at the periphery of the nesting areas using a vehicle as a blind. Monitoring is generally conducted in the mornings to minimize heat stress to chicks and to identify tracks of potential predators.

A number of investigations have been conducted to examine the effects of disturbance from monitoring on the reproductive success of seabirds (*Carney and Sydeman 1999*). In general, these studies have found that investigator disturbances lowered reproductive success of gulls, terns, and skimmers. However, some of these studies also indicate that adverse effects can be minimized by implementing appropriate protocols such as minimizing the number of visits into the colony, visiting colonies early in the day to avoid thermal stress to chicks, avoiding unnecessary handling of chicks, and moving slowly when inside colonies (*Carney and Sydeman 1999*). Safina and Berger (*1983*) found that skimmers were more sensitive to disturbance early in the breeding season, as well as during egg-laying and early incubation phases. The effects of disturbance were significantly greater when the colony was disturbed daily rather than weekly. Frequent disturbance during these times can result in nest abandonment. This study also found that disturbance after chicks have hatched can cause chicks to run long distances from the nest often resulting in death.

At the salt works, monitors have noted that once they have completed their activities, adults rapidly return to resume incubation and/or brooding. Despite the disturbance associated with monitoring, this activity plays a critical role in ensuring that nesting birds are provided adequate protection from predators. Monitoring data also provides the Refuge Manager with relevant observations regarding nesting and fledging successes and failures that can be used to improve management practices in subsequent years. The effects of disturbance are therefore offset by the indirect benefits to fledgling success that can result from monitoring. To ensure that monitoring activities are not resulting in excessive disturbance and consequently increased predation of chicks and eggs, the Refuge Manager will periodically review the monitoring protocols to make certain the benefits gained from monitoring are not outweighed by the losses caused by this activity.

The control of invasive plants, such as giant reed and castor bean, within the Otay River channel would benefit a variety of native birds supported by riparian habitat, as well as the light-footed clapper rail, which has been observed in this area on occasion. There is the potential for short-term disturbance impacts to some of these species during plant removal. These effects are expected to be minimal because of the precautionary measures taken during plant removal and the application of herbicides and the avoidance of such activities during the nesting season.

Predator management, as described in Appendix M, would directly benefit federally listed species, including the endangered California least tern and light-footed clapper rail and the threatened western snowy plover. Other seabirds and shorebirds that nest at the salt works would also garner indirect benefits from the reduction in predators during the nesting season. Predator management activities would result in negative effects on other avian species, including raptors and loggerhead shrikes. Section 4.4.1.1.2 provides a detailed discussion of environmental consequences of implementing the predator management plan described in Appendix M. Additional information regarding the implementation of this plan is provided below.

Predator management activities to control avian predators at the salt works are conducted annually between the months of March and September. These activities would continue under this and the other alternatives presented for the South San Diego Bay Unit provided funding continues to be available for this activity. The species controlled in the greatest numbers between 1999 and 2004 include the common raven (with 65 lethally removed) and western gull (with 134 lethally removed, including a number of sick individuals). Both of these species are known egg predators. American crows are also subject to control; however, the number of individuals removed from the Refuge over the past few years has been very low.

American kestrels, barn owls, and northern harriers are also controlled, sometimes lethally; however, lethal take of these species is initiated only after trapping has provided to be unsuccessful. Individuals that are trapped are release to Project Wildlife for relocation after the nesting season. Kestrels, which are relatively abundant in urban/suburban areas, are highly efficient chick predators that can seriously impact the productivity of an entire nesting colony. Kestrels are typically live trapped and relocated some distance from the salt works. However, when a relocated kestrel returns to a tern or plover nest site, its chances increase of being controlled by lethal means because it is often trap wary and therefore difficult to manage by non-lethal methods. Between 1999 and 2004, six kestrels were lethally removed and eight were released to Project Wildlife. During that same period, one harrier was lethally removed and one was released to Project Wildlife for release after the nesting season. In 2004, one barn owl was lethally removed. In past years, barn owls have been a significant problem, requiring the trapping of 12 barn owls in 1999 and ten in 2000. All 22 owls were released to Project Wildlife for relocation. The effects to kestrels and northern harriers of predator management within the salt works would be the same as that described under Alternative A for the Sweetwater Marsh Unit.

Other potentially affected species include the California gull, great horned owl, loggerhead shrike, and European starling. It should be noted that no loggerhead shrikes were lethally removed or trapped and relocated between 1999 and 2004 at the salt works. Because the potential for control of shrikes in the future would exist under this alternative, the adverse effects and proposed mitigation measures described under Alternative A for the Sweetwater Marsh Unit would also apply to the South San Diego Bay Unit.

Gull-billed terns, which also prey on least tern and snowy plover chicks and eggs, were considered for control at the salt works during the development of the predator management plan. However, because of the desire to maintain/enhance the numbers of breeding gull-billed terns in Southern California, it was determined that no lethal control of this species would be considered at this time. Instead, scientifically based monitoring on a limited scale will be conducted at the salt works during the 2005 nesting season in an effort to obtain a better understanding of gull-billed tern foraging activities. Limited monitoring of gull-billed tern nesting and reproductive success will also be implemented. This activity would continue in subsequent years provided funding is available to support such a monitoring program.

Subject to available funding, additional actions to reduce chick predation by gull-billed terns that could be implemented in subsequent years include initiating a pilot project to experiment with different types of chick shelters for California least terns and developing an experimental design to better document avian predation on both least terns and snowy

plovers. The Service's Migratory Birds Program would also continue to work with partners in Mexico to complete year two of a range-wide survey for gull-billed terns.

During the implementation of a predator management plan on the Refuge, some non-target birds could be unintentionally captured in traps set for targeted problem individuals. In most cases, such birds are immediately released at the capture site. Only when serious injuries have been sustained during trapping would non-targeted individuals be euthanized. Between 2001 and 2002, non-target species affected as a result of predator management at the salt works included one osprey, a Forster's tern, a black-necked stilt, a house sparrow, a black phoebe, and a northern mockingbird. The house sparrow, black phoebe, and northern mockingbird were injured during trapping and had to be euthanized; the other birds were released at the capture site.

In 2000, peregrine falcons were frequently observed foraging within the salt works where pole traps had been placed to control other targeted avian predators. As a result, although not targeted for control, two peregrine falcons were live captured in the pole traps. These individuals were turned over to the Santa Cruz Predatory Bird Research Group where they were banded and released at Grizzly Island in northern California. This is the only time peregrines have been captured in pole traps in the South Bay, although the traps are often used in areas frequented by peregrines.

The control of avian species other than kestrels, harriers, and shrikes on this Refuge during the breeding season would result in a small, localized reduction in the number of native birds within the Refuge lands; however, this reduction would not adversely affect population levels in coastal San Diego County or California.

Additional activities to be implemented at the salt works under this alternative include enhancing the nesting substrate on some levees to improve nesting conditions for the California least tern and creating additional foraging area for terns. Substrate enhancement would be implemented during the non-nesting season; therefore, no adverse effects to breeding seabirds would occur. The benefits of this enhancement include reducing the potential for chick mortality that can occur within the existing sediments on the levees adhere to the young chicks' feathers and beaks following heavy fog and light rain showers, and expanding nesting opportunities by create more desirable nesting areas throughout the salt works. Converting all or a portion of Pond 28 or 29 to tidally influenced habitat would also benefit seabirds and shorebirds by providing additional isolated areas of foraging and loafing habitat. No adverse affects to other avian species are anticipated.

No other significant habitat enhancement or restoration proposals are included under this alternative; therefore, the salt works and the Otay River floodplain would continue to be maintained as they are at present. The Otay River floodplain under current conditions provides very limited benefits to most avian species because of the degree of disturbance that has occurred here in the past.

The existing commercial solar salt operation within the Refuge provides protected roosting and specialized foraging habitat for shorebirds and waterbirds, particularly during high tide, and isolated nesting habitat for the California least tern and western snowy plover, and other colonial nesting seabirds, shorebirds, and waterfowl. A byproduct of salt production is the creation of conditions conducive to the production of brine invertebrates, such as brine flies and brine shrimp. The availability of these organisms provides

alternative foraging opportunities for some species and preferred foraging opportunities for invertebrate-feeding migratory species, such as phalaropes and eared grebes. Maintaining 90 acres of crystallizer ponds associated with salt production would provide only minor benefits to those few avian species that occasionally roost along the crystallizer ponds during periods of high tide.

Public Use

Under this alternative, the uses currently permitted on the Refuge, including fishing, boating, wildlife observation, and wildlife photography, would continue. The implementation of these uses within the Refuge all have the potential to result in disturbance to the avian species. The degree of disturbance would vary depending upon the use (*DeLong and Schmidt 2000, Huffman 1999, and Korschgen and Dahlgren 1992*). According to a human disturbance study conducted for the South San Diego Bay (*Huffman 1999*), of the various boating activities occurring in the South Bay, the greatest disturbance to the avian community came from motorized watercraft exceeding the speed limit.

Between January and March 1998, the effects of watercraft on wintering birds in South San Diego Bay were observed and recorded. The results of this study indicated that operating any watercraft (e.g. motorized boats, non-motorized boats, jet skis, wind surfers, parasurfing), within the South Bay resulted in some level of disturbance to waterbirds. The degree of disturbance depended upon the vessel's speed, proximity to rafting birds, proximity to the shoreline, and amount of noise produced during operation. During the study only 7% of motorized boats were observed obeying the 5 mph speed limit. The remaining 93% traveled at speeds that produced a wake (*Huffman 1999*). Disturbance was greatly reduced when boats traveled at the posted "No Wake" speed (5 mph). Reactions to disturbance were greater within 150 meters of the salt pond levees and Chula Vista Wildlife Reserve shoreline than they were further to the north where boating and fishing activity is generally more frequent. Observations made during waterbird surveys conducted between April 1993 and April 1994 confirmed that areas with relatively low water recreational intensity supported a greater abundance of waterbirds (*USFWS 1995*). The effect of motorized watercraft on shorebirds foraging along the edge of the bay was also studied (*Huffman 1999*). Observations indicated that watercraft within 100 meters off the shore flushed all waterfowl between the boat and shore and any shorebirds along the shoreline regardless of the speed of the watercraft. This was also true for windsurfers traveling less than 100 meters offshore. Similarly, when non-motorized vessels, including kayaks, canoes, and longboats, came within 30 meters of the shoreline all waterfowl between the craft and the shore would flush.

Based on the observations of the various studies described above, it would appear that boating activity conducted in accordance with existing speed restrictions would have only minor adverse effects on migratory birds in the open bay. However, adverse effects to shorebirds feeding and loafing along the shoreline and on the surrounding mudflats would be greater if frequent motorized boating activity occurs within 100 meters or non-motorized watercraft activity occurs within 30 meters of such foraging areas.

Disturbance to nesting seabirds at the salt works from activities associated with watercraft can occur when a vessel approaches too close to the outer levees or when a watercraft is landed on the levees allowing human encroachment into nesting areas. Access to the outer levees is possible for low draft watercraft during high tides, although such occurrences have been rare. Seabird responses to such disturbance vary with date, nature of the disturbance, and other unknown factors. These responses can include flocking, alarm

calling and in some species, diving on individuals present along the levee. Human disturbance early in the nesting season can result in the entire nesting colony abandoning the site. Nest abandonment and inter-colony antagonistic behaviors that lead to crushed eggs and chick mortality may result from such disturbance episodes. Predatory species often take advantage of these disturbance responses by stealing eggs and chicks while the adults are flocking or otherwise distracted. Breeding colonial waterbirds are particularly susceptible to impacts related to disturbance because of their high-density nesting habits (*Rodgers and Smith 1995*).

In addition to potential adverse effects to waterfowl and seabirds related to disturbance, recreational fishing on the bay can also result in indirect impacts to the avian species supported by the Refuge. These impacts, which can be lethal, relate to the accumulation of fishing line along the outer levees and within the bay. Shorebirds, seabirds, waterfowl, and pelicans can become entangled in improperly discarded fishing line resulting in the death of the bird. This problem would be expected to continue under this alternative.

Opportunities for wildlife observation, which would be provided under this alternative, include observing wildlife in the bay from watercraft and participating in guide tours of the salt works. To minimize disturbance to nesting birds from wildlife observation activities, no guided nature tours are conducted during the nesting season, and disturbance during the remainder of the year is minimal because only one or two tours conducted each month during the nonbreeding season.

Solar Salt Operation

Continuation of commercial salt production on the Refuge could result in some limited disturbance to foraging and loafing shorebirds, seabirds, and waterfowl; however, the presence of the commercial operator on this site also benefits avian species by maintaining the isolated nature of the site through strict enforcement of no trespassing regulations. During the nesting season, disturbance from the commercial operation is avoided by prohibiting activities on those levees known to support nesting birds. The low frequency of disturbance and the isolated nature of the salt ponds provide a benefit to colonial seabirds that return to this site each year to nest.

4.4.2.1.2 Effects to Fish

Habitat and Wildlife Management/Public Use

The reintroduction of tidal influence into Pond 28 or 29 under Alternative A or B would expand to some extend the area of available fish habitat within the South Bay. No other benefits to fish would result from the implementation of Alternative A. Also under this alternative, some incidental fish loss would occur as a result of fishing activities permitted within the open waters of the Refuge, and other fish would be lost as a result of being trapped in the salt ponds after entering the system through the tide gate in Pond 10.

4.4.2.1.3 Effects to Invertebrates, Amphibians, and Reptiles

Habitat and Wildlife Management/Public Use

No adverse or beneficial effects to invertebrates, amphibians, and reptiles would occur as a result of implementing this alternative.

4.4.2.1.4 Effects to Mammals

Habitat and Wildlife Management

With the exception of the implementation of predator management, the management activities and public uses proposed under this alternative would have no beneficial or adverse effects on mammals. Mammals subject to predator management would be the same as those described in Alternative A for the Sweetwater Marsh Unit. During the 2002 breeding season, 20 California ground squirrels, 13 black rats, seven striped skunks, three opossums, three Norway rats, three feral cats which were released to an animal shelter, a coyote, and a bobcat were removed from the Refuge to protect nesting terns. The continued control of native mammalian predator species on this Refuge during the breeding season could result in a localized reduction in the number of coyotes, ground squirrels, and striped skunks within the Refuge lands; however, this reduction would not adversely affect the overall population levels of any of the target species.

Public Use

Continuing to permit limited public access within this Refuge Unit for fishing, boating, wildlife observation, and environmental education would have no effect on the mammals supported on this Refuge Unit.

4.4.2.2 Alternative B –Enhance Nesting Habitat

4.4.2.2.1 Effects to Waterfowl, Seabirds, Shorebirds, Other Waterbirds, and Land Birds

Habitat and Wildlife Management

In addition to the management activities included in Alternative A, Alternative B also includes proposals to initiate a public outreach program intended to reduce the accumulation of improperly discarded fishing line and other debris in the bay and expand current law enforcement activities by conducting periodic patrols within Refuge waters in an effort to control boating speeds within the Refuge boundary. Both of these proposals would provide benefits to the Refuge's avian species. The effects of predator management on avian species under this alternative would be the same as those described under Alternative A.

Management of the Refuge under this alternative would also include the continued operation of the salt works in essentially the same configuration as described in Alternative A and no restoration of the Otay River floodplain. Many of the potentially adverse effects and benefits to avian species described under Alternative A would also be realized under this alternative.

Habitat Enhancement

The creation of 18 acres of nesting habitat within the salt works and enhancement of up to an additional ten acres of existing nesting area on the levees would improve nesting opportunities for the colonial nesting seabirds and shorebirds that nest in the South Bay. Added nesting area should reduce competition for nesting space and vulnerability to predators, while potentially also improving reproductive success. Enhancement of the substrate on the levee tops would also eliminate the adverse effects created when the existing silty substrate mixes with rain to form a glue-like substance that sticks to young chicks as it dries, often leading to the death of the chick. This benefit should contribute to improved fledgling success.

Recontouring some of the side slopes along the levees would improve chick access to the edge of the ponds where foraging opportunities exist. Some levees would remain unaltered to minimize the loss of nesting and brooding habitat for American avocets and black-necked stilts.

Lowering the water level in Pond 20 to create some salt flats within the pond during the breeding season would create potential nesting sites for the western snowy plover, which could result in improved fledging success. The low water levels and exposed surfaces would also provide benefits for foraging shorebirds and other waterbirds, particularly during periods of high tide.

Some of the levee slopes support pickleweed and upland transition vegetation that is used by Belding's savannah sparrows for foraging and nesting. To minimize the loss of sparrow habitat as a result of levee enhancements, a survey would be conducted prior to the completion of a detailed levee enhancement plan to identify those sparrow habitat areas to be preserved. No other impacts or benefits for waterfowl or land birds would result from the proposed nesting substrate enhancements.

Public Use

Public uses would not be expanded under this alternative; therefore, the effects to these Refuge resources would be the same as those described for Alternative A.

4.4.2.2.2 Effects on Fish

Habitat and Wildlife Management/Public Use Program

No new adverse or beneficial effects to fish would result from the management actions proposed under Alternative B and no new public uses are proposed under this alternative. Minor losses of individual fish would continue as a result of fishing and the operation of the salt works, as described for Alternative A.

Habitat Enhancement

The seabird nesting enhancements proposed under this alternative would occur entirely within the confines of the salt works; therefore, these proposals would have no direct adverse or beneficial effects on the fish populations within the bay. These improvements could however lead to indirect adverse effects to fish if the number of fish-eating birds using these nesting areas increases following enhancement. This potential adverse effect is not however considered significant.

4.4.2.2.3 Effects to Invertebrates, Amphibians, Reptiles, and Mammals

Habitat and Wildlife Management/Public Use

The effects to these organisms would be the same as those described under Alternative A for the South San Diego Bay Unit.

Habitat Enhancement

The seabird nesting enhancements proposed under this alternative would have no effect on the invertebrate, amphibians, reptiles, or mammalian populations within the Refuge.

4.4.2.3 Alternative C – Expand and Restore Habitat/Expand Public Uses

4.4.2.3.1 Effects to Waterfowl, Seabirds, Shorebirds, Other Waterbirds, and Land Birds

Habitat and Wildlife Management

The habitat management activities described in Alternative A and B would also be implemented under this Alternative; therefore, the potential adverse and beneficial effects of implementing these actions would be the same as those described for the previous alternatives.

Habitat Restoration

Effects to Waterfowl, Seabirds, Shorebirds, Other Waterbirds

Otay River Floodplain. The construction activities required to restore the Otay River floodplain under either Option 1 or Option 2 could have short term, adverse impacts to the low numbers of seabirds, shorebirds, waterfowl, and other waterbirds that utilize the habitats within the Otay River channel for foraging, loafing, roosting, and/or nesting. Impacts would range from the temporary displacement of avian species due to grading activities in and around the river channel to some loss of existing habitat. Option 1 would have a slightly greater impact on existing wetland resources than Option 2, because all of the Otay River channel would be reconfigured under Option 1. Under Option 2, the northern portion of the channel would remain unchanged. The construction period would be longer for Option 2, as more earthwork would be required to achieve the restoration objectives. Restoration activities within the upland areas of the floodplain would also temporarily eliminate potential terrestrial foraging areas for raptors and other land birds, as well as the gull-billed tern. The proposed restoration activities could displace some of the affected species for up to two years, depending upon the length of time required for revegetation of disturbed habitat. During this time suitable habitat for displaced species would continue to be available to the south and east of the refuge and within the southern portion of Pond 20A.

To avoid impacts to the light-footed clapper rail, a directed survey for this species would be conducted prior to construction. Any individuals observed would be removed from the area and maintained at an appropriate facility until they can be safely released back into the restored habitat. Monitoring would also be conducted during construction in an effort to avoid the loss of any previously unobserved clapper rails. Although there remains a potential for short-term adverse impacts to this species, restoration once completed would provide significant benefits to the clapper rail in the form of expanded foraging and nesting habitat and overall improvements in habitat quality.

The proposed restoration would provide significant long term benefits to waterbirds, seabirds, shorebirds, and waterfowl as 63 acres of tidally influence coastal salt marsh habitat and 19 acres of freshwater wetland habitat would be restored under Option 1; a total of 88 acres of tidally influenced coastal salt marsh habitat and 17 acres of freshwater wetland habitat would be restored under Option 2. Restoration of habitats that historically dominated the southern end of San Diego Bay would significantly increase the availability of foraging and roosting areas.

Salt Works. Salt Works Restoration Option 1 would result in the restoration of approximately 213 acres of intertidal habitat. As a result of converting these ponds to tidally influenced areas, some avian species (e.g., eared grebes, phalaropes) could be displaced, while many other avian species would benefit from expanded foraging

opportunities. A wide range of shorebird species in particular would benefit from the increase in available intertidal habitat. This conclusion is supported by observations made in 1984 when a large salt pond adjacent to Elkhorn Slough was inadvertently exposed to tidal action. Following the failure of a dike and the introduction of tidal action into the pond, shorebirds that had not been previously observed feeding within the pond began to feed on the new intertidal mudflat (*Ramer, Page, and Yoklavich 1991*).

Surveys conducted at the salt work in 1993/1994 found that the ponds to be restored under Option 1 supported a high diversity of bird species, with 54 species observed in Pond 11, 59 species in Pond 10, and 57 species in Pond 10A (*Stadtlander and Konecny 1994*). In terms of the total abundance of birds present in the ponds, 201 to 1000 individuals per hectare were observed in Ponds 10 and 11 and 1001 to 4000 individuals per hectare were observed in Pond 10A. The group or guild most represented in Pond 11 was waterfowl, due in part to the observation of a significant number of lesser scaup in the pond in February 1993. Lesser scaup were also highly abundant within those cells surveyed to the north of the Pond 11 in the open bay. Other waterfowl such as bufflehead, American wigeon, gadwall, and northern shoveler (*Anas clypeata*) that occurred in high or moderate numbers within these three ponds were also found at similar abundance levels in the open bay. The only exceptions were red-breasted merganser (*Mergus serrator*) and ruddy duck, which were more abundant in these ponds than in the open bay, although they were also observed at moderate abundance levels in all cells surveyed within the open bay.

A review of the various species observed within these ponds suggests that the guild of birds mostly likely to be displaced as a result of converting these ponds from open water to a tidal regime would be waterfowl. Waterfowl would still be expected to occur in these ponds, but not at the numbers observed under existing conditions in which the water levels in the ponds are considerably more stable. Waterfowl that presently raft in these ponds would most likely move to other ponds in the system or to the adjoining open bay. Overall waterfowl diversity and abundance within the Refuge is therefore not expected to be adversely affected.

The foraging and rafting activities of phalaropes and eared grebes would be affected by the changes in the pond system as a result of implementing Option 1, although these effects are not expected to significantly alter the use of the ponds by these species. Eared grebes are routinely observed rafting on the majority of the ponds within the existing salt works, with highest densities occurring in the ponds located to the east of the Otay River. Phalaropes are observed primarily within the ponds to the east of the Otay River, as well as along the mudflats to the north of the salt works. Confining the salt operation to the east side of the Otay River is not expected to significantly reduce resting and foraging opportunities for either eared grebes or phalaropes.

During low tide, foraging and loafing opportunities for herons, egrets, and shorebirds, which frequent these ponds, would be expected to increase as a result of restoration, and during high tide, greater fish diversity and abundance would be present in the ponds, additional foraging opportunities for migrating and nesting seabirds. The current roosting opportunities available to gulls, pelicans, and cormorants along the levee that separates Ponds 10 and 11 would not be altered; however the changes surrounding this levee would change from an open water environment to a tidal regime. It is not known if this change would have any effect on the current roosting habits of these birds.

Large areas of cordgrass-dominated salt marsh with adequate tidal flushing are considered the preferred habitat areas of the light-footed clapper rail (*Jorgensen 1975 in U.S. Navy 2000*), a perilously endangered species that currently occurs in extremely low numbers in the southern end of the bay. The intent of this restoration option is to create approximately 160 acres of relatively secure clapper rail habitat, which would represent a significant benefit to the region's clapper rail population.

Salt Works Restoration Option 2 proposes to convert all of the primary ponds, a total of approximately 510 acres, to intertidal habitat. The restoration in Ponds 10, 10A, and 11 would be identical to that proposed in Option 1; therefore, the potential adverse and beneficial impacts of restoring these three ponds to tidal influence would be the same as previously stated.

Restoration of the eastern primary ponds would involve raising the elevations in Ponds 12 and 13 with the intent of providing additional cordgrass-dominated salt marsh, while simple breaching would support intertidal mudflats in Ponds 14 and 15. Similar to Restoration Option 1, restoration of all the primary ponds would displace rafting waterfowl to the remaining ponds in the system and/or to the open bay. However, many of these species would be expected to forage in the restored intertidal areas since biological diversity and productivity is expected to increase once tidal influence is restored.

The extent of change to the salt pond system proposed under Option 2 could result in the displacement of other species, such as phalaropes and eared grebes. Under this alternative, commercial salt making would continue but within a reduced footprint, therefore reducing the total area available for resting and foraging. Brine flies, brine shrimp, and other invertebrates associated with hypersaline environments would continue to be supported within the pond system, but their distribution within the remaining ponds would change from existing conditions and the overall densities of brine shrimp and brine flies would be reduced. There is no data available that can help us predict how the use of these ponds by eared grebes and phalaropes could change following restoration. Jehl (*1988*) describes phalaropes and eared grebes as "behaviorally flexible" and able to readily exploit new situations. Therefore, the shift in location and density of brine invertebrates within the ponds may have no adverse effects on these species. Conversely, a reduction in the availability of brine invertebrates could result in one or more of these species abandoning their use of the salt ponds as a foraging site during migration. Should eared grebes and/or phalaropes abandon the site, the loss of these species would represent a slight reduction in the overall avian diversity within Refuge, representing an adverse but less than significant effect. Further, because the number of birds that visit this site each year only represents a small percentage of the total population of these species, no adverse effects to the overall population of eared grebes, northern phalaropes, and Wilson's phalaropes would result from this action.

The eastern primary ponds provide little value for fish eating birds; therefore, opening these ponds to tidal influence would be expected to improve foraging opportunities for gulls, terns, and pelicans. In addition, the majority of the levees around these ponds that currently provide roosting, loafing, and nesting opportunities for terns, gulls, pelicans, and some shorebirds would remain intact following restoration. The conditions around these levees would however be changed. The open water areas around the levees would be replaced by salt marsh and intertidal mudflat habitat with water levels that would fluctuate with the tides.

No research has been conducted that would support an accurate prediction of how nest site selection could be effected by this change in conditions around the levees. Even under existing conditions, nesting patterns and species abundance and diversity can vary from year to year. This is particularly true of the elegant tern, which has a particularly erratic nesting history at the salt works. As conditions within the salt works are changed, there is the potential that one or more species could be displaced. It is also possible that little or no changes in current nesting patterns on the levees would be observed. This conclusion is based on a review of the conditions surrounding other colonial seabird nesting sites on the Pacific Coast. Examples include Bolsa Chica and Upper Newport Bay. At Bolsa Chica, two nesting islands created within a tidally influenced impoundment support a variety of colonial nesting seabirds including Caspian, Forster's, elegant, and royal terns, and black skimmers (*Seto et al 2003*). Both of these islands are surrounded by intertidal salt marsh habitat. Similarly, two islands in Upper Newport Bay Ecological Reserve currently provide nesting habitat for California least terns (~25 pairs), Forster's terns (colony size unknown) and black skimmers (300-350 pairs) (*Seto et al 2003*). These islands are situated within an existing tidal flat, with no water body separating the islands from the mainland during low tide. At this location, Caspian terns do not nest on the islands, although they do forage and roost in the vicinity. Similar to the current proposal for the salt works, the tidal flats and salt marsh that surround the islands in Upper Newport Bay are managed for the light-footed clapper rail. Another example of seabirds nesting in areas that are not surrounded by open water is provided at Isla Montague in the Gulf of California. Here elegant terns have been observed nesting on islets surrounded by low marsh vegetation (*Burness et al 1999*). Within the salt works, various tern species have been observed nesting along the outer levees of Ponds 12, 14 and 15 within the South San Diego Bay Unit. During the 1998 nesting season, Caspian terns, black skimmers, and Forster's terns were observed nesting on these outer levees, which abut the intertidal mudflats of San Diego Bay (*Stadtlander and Konecny 1994*).

Included as part of this alternative are additional management activities that would be implemented to maintain those conditions that appear to favor seabird nesting along the salt pond levees. Such activities include the installation of new fencing and regulatory signage to minimize human and mammalian disturbance in the nesting colonies and monitoring and periodic removal of vegetative cover on the levees to maintain open views of the surrounding area for the nesting seabirds. Tern species including gull-billed, royal, and elegant terns appear to prefer nesting sites with good visibility; therefore, where necessary, the clearing of vegetation along the levees prior to the nesting season would maintain high quality nesting habitat for these species (*Parnell et al 1995, Buckley and Buckley 2002, Burness et al 1999*).

In an effort to ensure the continued use of the levees for seabird nesting, nesting activity on the levees would be monitored throughout the construction period, as well as following restoration, to determine the effects, if any, of the changed conditions within the salt works on the various nesting seabird colonies. Over the years, seabird distribution and abundance at the salt works has varied in response to a variety of factors, including shifts in the abundance of preferred prey species in the adjacent marine environment due to climatic changes (*Horn and Dahdul 1998*). Therefore, interpretation of the monitoring results would consider the conditions in the immediate vicinity of the levees, as well as those of the surrounding area. If abandonment of one or more of the seabird colonies does occur following restoration, specific management actions would be developed and implemented in an attempt to reestablish the colony. Such actions could include 1) intensifying predator management actions, if predation is determined to be the cause for

abandonment; 2) reducing disturbance related to public use on the levees, boats operating adjacent to the levees, and/or monitoring activity that occurs within the colonies; and 3) restoring an open water component around some of the levees or other nesting areas by constructing moat-like structures adjacent to the nesting area. These and other adaptive management actions would be more fully defined as part of the final restoration plan.

Effects to Land Birds

Otay River Floodplain. Restoration of the Otay River floodplain under Option 1 or Option 2 would convert approximately 140 acres of non-native grassland to a combination of freshwater wetland, coastal salt marsh, and native shrub habitats. The loss of these grasslands could reduce foraging opportunities for species, such as the red-tailed hawk and white-tailed kite, which feed on small mammals supported by this habitat. This loss of foraging habitat would not represent a significant direct adverse effect for these species; however, it would contribute to the cumulative loss of similar habitat throughout the region. These cumulative effects would be offset by the preservation of foraging habitat for these species within the San Diego NWR, which is located further to the east.

Other birds of prey, such as northern harriers, falcons, and osprey, that regularly forage in estuarine habitat could benefit from this restoration. The effects to these raptors of implementing one restoration option over the other would be indiscernible.

Land birds, such as mourning doves, western meadowlarks, and Brewer's blackbirds that are supported primarily by open grassland habitat could be displaced by the conversion of the nonnative grasses to native wetland and upland scrub vegetation. These effects would be partially reduced for some species, such as towhees, common bushtit, and finches, by establishing native vegetation on the restored upland areas.

The implementation of Restoration Option 1 would increase the total acreage and quality of the riparian habitat within the Refuge by restoring approximately 13 acres of southern willow scrub habitat along the Otay River channel. Establishing willows and mulefat within the river channel would provide habitat known to support two federally listed endangered species, the least Bell's vireo and southwestern willow flycatcher. These species occur upstream within the Otay River drainage and in the adjacent Tijuana River Valley, but have not been observed within this Refuge. The improved habitat quality of the freshwater wetlands within the Otay River floodplain would also benefit several other land birds associated with freshwater habitats including common yellowthroat, red-winged blackbirds, wrens, and swallows. Although Option 2 would also provide potential benefits to the least Bell's vireo and southwestern willow flycatcher, only five acres of southern willow scrub habitat are proposed, therefore, the benefits to these species would be less than those provided under Option 1.

Other land birds, such as Belding's savannah sparrow and belted kingfisher, would benefit from the increase in wetland habitat proposed under either restoration option, with Option 2 providing slightly higher benefits than Option 1.

Salt Works. The conversion of salt ponds to intertidal habitat, as proposed in Salt Works Restoration Options 1 and 2, would have no adverse effects on raptors. Osprey, which occasionally forage on fish trapped in the primary pond system, would benefit from pond restoration as the diversity and abundance of fish in these ponds would be expected to increase following breaching. Other birds of prey, including northern harriers and falcons,

that forage in salt marsh habitats would also benefit from the expansion of this habitat into the South Bay.

Belding's savannah sparrow would benefit from the increase in salt marsh habitat that would occur under either restoration option for the salt works.

Public Use

Recreational Boating. Recreational boating would continue to be permitted within the bay under this alternative, resulting in effects to avian species that would be similar to those described under Alternative A. The proposal to increase enforcement of the existing speed limit within the bay would be expected to reduce existing incidents of disturbance due to excessive boating speeds in the South Bay.

Onshore Fishing and Wildlife Observation. Under this alternative, fishing would be permitted within the open bay, as well as along the northern levee of Pond 11. The effects of recreational fishing in the bay on avian species would be the same as those described under Alternative A. Fishing activity along the northern levee of Pond 11 could result in disturbance to birds foraging and loafing on the existing and restored mudflats and salt marsh habitat located adjacent to the levee. The potential for disturbance is documented in various studies conducted to evaluate the effects of public uses on wildlife (*DeLong and Schmidt 2000*). Some of the adverse effects of disturbance include alterations in behavior, reproduction, and distribution. Disturbance to migratory birds as a result of pedestrian activity along the shoreline has been observed in South San Diego Bay; with the greatest disturbance occurring during low tides when pedestrians left designated accessways to explore the mudflats (*Huffman 1999*). This activity impacted both shorebirds and waterfowl. Huffman observed that human activity along the shoreline and in the mudflats would flush all birds within a 50 to100 meter radius; therefore, human activity on this levee could result in disturbance both to the north and south of the levee. The level of activity to be permitted on this levee under this alternative could result in frequent disturbance to adjacent foraging areas, resulting in lost foraging time and additional energy expenditure for migrating birds. In modeling the energy costs of such disturbance for oystercatchers, West et al (*2002*) concluded that when the time and energy costs arising from disturbance are considered, frequent disturbance can be more damaging to migratory birds than permanent habitat loss. Therefore, opening this levee to human activity could adversely affect migratory birds by effectively reducing the availability of foraging habitat in proximity to the levee. This impact would be offset by the proposal to restore significant areas of tidally influenced habitat throughout the salt works, which would provide alternative foraging areas for migratory birds displaced by this human disturbance.

Opening this levee to human activity would also adversely affect Belding's savannah sparrows that occupy the high marsh habitat growing along the slopes of the levee. Human disturbance in these areas could result in the permanent displacement of these individuals to other portions of the Refuge.

Human intrusion into sensitive habitat areas during low tide could also occur as a result of opening this levee to public access. The South Bay Biological Study Area, located immediately to the north of the levee, provides nesting and foraging habitat for the light-footed clapper rail and the area to the south of the levee is intended to be restored to habitat known to support clapper rails. The repeated presence of humans in these areas could disrupt natural behaviors, such as foraging, brooding, and tending of young. With enough disturbance, birds may abandon the area altogether in search of more suitable

habitat. To minimize the potential for human intrusion into adjacent areas, subsequent plans for preparing this levee for public use would incorporate effective measures for restricting access to the levee.

For the past several seasons, tern colonies have been located on the levee surfaces east of the Otay River channel several hundred of meters away from Pond 11's northern levee. Biologists performing seabird nesting surveys report that these colonies may respond to pedestrian traffic on the west side of the Otay River along the levee surfaces. Responses, which vary with date and the nature of the disturbance, include flocking, alarm calling and in some species, diving on individuals present along the levee. Nest abandonment, colony abandonment and inter-colony antagonistic behaviors leading to crushed eggs and killed chicks can also occur during disturbance episodes. Predatory species may also use disturbance episodes to depredate eggs and chicks while the adults are flocking or otherwise distracted. Responses to disturbance from activities on the levee would be monitored to reduce the potential for adverse effects to nesting seabirds as a result of permitting public access along the north side of Pond 11. If adverse effects are observed, access to some or all of the levees would be restricted during the nesting season.

As described in Alternative A, fishing activity can also result in indirect adverse effects to avian species as a result of the accumulation of fishing line along the shoreline and within the shallow areas of the bay. Opening the levee to shoreline fishing could increase the accumulation of discarded fishing line within the Refuge. Proposed public outreach and organized clean ups could minimize, but not eliminate, the threat that discarded fishing line would pose to migratory birds, rails, and seabirds. In addition, public access on the levee would result in some level of trash accumulation. Trash, discarded bait, and other materials even when discarded in approved receptacles can attract gulls, ravens, and crows that are common predator species of seabird chicks and eggs. If trash accumulation becomes a threat to fledging success, it may be necessary to close this levee to public access during the nesting season.

Under this alternative, Pond 11's northern levee would also be available for activities related to wildlife observation and photography. Although indirect impacts related to fishing line accumulation would not result from these uses, the potential for other direct and indirect impacts, as described above for fishing along the levee, would also be expected for any uses that involve public access on the levee.

Guided Tours of the Salt Works. Opportunities for wildlife observation and photography and environmental interpretation would also be provided through the proposal to conduct routine (twice a month) guided nature tours along the outer levees of the salt works. To avoid adverse effects to nesting seabirds, these tours would not be conducted during the nesting season. Disturbance and possible displacement of migratory shorebirds could occur if guided tours result in excessive out-of-vehicle activity. Observations on other Refuges indicate that out-of-vehicle activity is more disruptive to avian species than vehicular movement through an area (*Klein 1993 in DeLong and Schmidt 2000*). Although the degree of disturbance may vary for the species and local populations of birds occurring within the South San Diego Bay Unit, similar differences between out-of- vehicle activity and vehicle travel on the salt works would be expected. If the disturbance level is too excessive, the avoidance response by migratory birds could increase and some species may avoid foraging habitat located near the tour route. The benefits of the proposed tours to avian species include making the public more aware of the need to reduce disturbance to migratory birds and providing the public with an appropriate means for observing the

birds within the Refuge. These lessons are expected to help reduce inappropriate public intrusion into sensitive habitat areas for the purpose of observing the Refuge's wildlife.

Environmental Education. The environmental education program proposed for the area located to the north of the Bayside Elementary School is not anticipated to result in any adverse effects to avian species, as the level of disturbance would not increase over existing conditions. The benefits of this program to avian species include educating students about the need to conserve habitat for a wide variety of avian species and teaching them the importance of reducing disturbance in those native habitats that have been conserved.

Environmental Interpretation. The primary interpretive program under this alternative would involve working with other agencies to develop a coordinated interpretive program around the bay. Interpretive elements in the vicinity of the Refuge would be installed along the Bayshore Bikeway, where public access is already permitted. The potential for disturbance of avian species in adjacent habitat areas would not increase, and could decrease, as a result of interpretation.

Otay Valley Regional Trail. Another use considered under this alternative is the designation of a future trail corridor, intended to accommodate the Otay Valley Regional Trail. The trail would be aligned along the eastern boundary of the Refuge, in proximity to I-5. Studies indicate that the physical presence of a trail and the human disturbance associated with the trail can effect bird abundance, species composition and nest predation in the immediate vicinity of a trail (*Delong and Schmidt 2000*). Through proper trail planning that limits fragmentation of habitat, avoids sensitive habitat areas, and establishes clearly defined paths to reduce off trail activities, many of these potential effects can be avoided. The proposed trail would be located at the edge of the Refuge away from sensitive coastal wetlands and seabird nesting areas; therefore, no adverse effects to shorebirds, seabirds, waterfowl, or waterbirds are anticipated.

4.4.2.3.2 Effects to Fish

Habitat and Wildlife Management/Public Use

The Refuge operation activities and expanded public uses proposed under this alternative would provide no new benefits or adverse effects to fish populations within the Refuge.

Habitat Enhancement and Restoration

Short-term impacts to fish as a result of implementing Otay River Floodplain Restoration Option 1 or 2 would be minimal (refer to Sweetwater Marsh Unit, Alternative B); however, the restoration of 60 to 90 acres of intertidal habitat would result in moderate benefits to various fish species, particularly those species that breed, spawn, and/or forage in the intertidal zone. Expanding the availability of salt marsh habitat adjacent to the bay would provide new foraging and spawning areas for a number of fish species known to occur in the bay, as well as provide these species with cover to protect them from predators.

The restoration of the salt works under Salt Works Restoration Option 1 would result in temporary salinity increases in the South Bay, as described in Section 4.2.2.3.3. Salinity increases would be relatively minor and short in duration; therefore, these changes are not expected to adversely affect the fish population in the South Bay. Restoration under Option 2 would result in slightly higher temporary increases in the salinity levels in the bay immediately following breaching. Assuming the ponds are full upon breaching, salinity increases above 38 ppt would be limited to the areas south of the Chula Vista Wildlife Reserve and to the first week following breaching. Salinities would peak at 50 ppt

during the first ebb tide and would decrease to approximately 40 ppt one day after breaching. Although few studies have been conducted to determine the salinity tolerances of the fish species that occur in San Diego Bay, a study of salinity tolerances in a number of fish species in Los Penasquitos Lagoon provides some observations regarding the salinity tolerances of several of the more abundant fish species in the South Bay. Specifically, California killifish and topsmelt were observed to be thriving in Los Penasquitos Lagoon at salinity levels as high as 63 ppt, while California halibut appear to tolerate salinities of between 50 and 55 ppt (*Carpelan 1961*). In this same study, the upper limit for pipefish appeared to be about 50 ppt and 55 ppt for Shiner surf perch. Based on these observations, it would appear that these species would be unaffected by the short-term increase in salinity that would occur under this alternative. Other species that may be less tolerant of salinity increases could swim north to areas of the bay that would not be impacted by this temporary increase in salinity levels. The temporarily displacement of these fish would not adversely affect fish diversity or abundance within the South Bay.

Significant benefits to fish would result from the establishment of vegetated tidal marsh within the breached ponds. These vegetated marsh areas would provide foraging habitat for adult and juvenile fish, protected spawning areas, and cover from predators.

4.4.2.3.3 Effect to Invertebrates

Habitat and Wildlife Management/Public Use

The management activities and public uses proposed under this alternative would result in no new adverse or beneficial effects to these organisms.

Habitat Restoration

Some loss of terrestrial and freshwater invertebrates could occur as a result of restoring the Otay River floodplain in accordance with Option 1 or 2; however, these losses are expected to be minimal. To avoid unanticipated impacts to sensitive terrestrial invertebrates, a survey of the restoration area would be conducted prior to project implementation and if the potential for adverse effects to such species are identified, appropriate measures would be implemented to minimize these effects. The restoration of 60 to 90 acres of intertidal habitat, as proposed under this alternative, would significantly benefit a variety of marine and estuarine invertebrates by expanding available habitat and increasing tidal circulation, which results in improved water quality and the increased availability of nutrients.

The restoration of the western primary salt ponds (Salt Works Restoration Option 1) would result in temporary salinity increases in the South Bay that would not be expected to adversely affect marine and estuarine invertebrates. Although restoration under Salt Works Restoration Option 2 would result in slightly higher temporary increases in the salinity levels in the bay immediately following breaching, the levels are not considered high enough to result in adverse effects to the bay's invertebrate populations. Once tidal influence is restored to the ponds, it is anticipated that marine and estuarine invertebrates would once again become established within this portion of the Bay. These organisms would derive significant benefits from the availability of expanded habitat and improved tidal circulation.

4.4.2.3.4 Effects to Amphibians and Reptiles

Habitat and Wildlife Management/Public Use

The management activities and public uses proposed under this alternative would not adversely affect or provide benefits to these organisms.

Habitat Restoration
Restoration of the Otay River floodplain could displace some amphibian and reptile species currently supported by this upland area. To date, no surveys have been conducted to determine if sensitive species currently occupy this area. To avoid unanticipated impacts to sensitive reptiles and amphibians, a survey of the restoration area would be conducted prior to project implementation. If a significant population is identified, the restoration plans would be revised to protect the population from any significant adverse effects.

4.4.2.3.5 Effects to Mammals

Habitat and Wildlife Management/Public Use
The effects of predator management on the Refuge's mammalian population would be the same as those described under Alternative A. The other management activities and public uses proposed under this alternative would result in no new adverse or beneficial effects to these organisms.

Habitat Restoration
Restoration of the Otay River floodplain would convert disturbed upland area that supports a variety of native and non-native mammals to coastal wetlands. This action could displace some mammals, while continuing to support others. Despite these changes, no significant adverse effects to the mammalian populations in the vicinity of the Refuge are anticipated.

4.4.2.4 Alternative D –Maximize Habitat Restoration/Moderately Increase Public Use (Preferred Alternative)

4.4.2.4.1 Effects to Waterfowl, Seabirds, Shorebirds, Other Waterbirds, and Land Birds

Implementation of this alternative would result in benefits to avian species as a result of restored freshwater wetland, native upland, and coastal salt marsh habitat within the Otay River floodplain and the availability of a combination of tidally restored ponds and managed ponds within the existing salt works. Changes within the salt ponds could displace some avian species that rely on the resources within the active salt ponds, although this alternative does include a brine management component that is intended to provide habitat conducive to the production of brine invertebrates. Unlike the other alternatives being considered, this alternative proposes to convert the entire salt works system into habitat types suitable for supporting a variety of avian species. The other alternatives propose the continuation of salt production in some form. This would result in retaining a portion of the Refuge, specifically the crystallizer ponds, in a condition that would provide little if any habitat value for wildlife.

Habitat and Wildlife Management
The habitat management activities described in Alternative A and B would also be implemented under this alternative. The potential adverse and beneficial effects of implementing these actions would be the same as those described for the previous alternatives.

Habitat Restoration
The restoration options described in Alternative C for the Otay River floodplain are also proposed under this alternative; therefore, the adverse and beneficial impacts to avian species described in Alternative C would also be realized under this alternative.

Under existing conditions, the salt ponds provide approximately 970 acres of water surface within a configuration which the salinities in the system progressively increase from ambient bay levels (about 33 ppt) at the initial intake ponds (the primary ponds) to about 370 ppt in the crystallizer ponds. The primary and secondary ponds support a variety of avian species, as described in Chapter 3. Under this alternative, approximately 670 acres would be converted to tidally influenced habitats ranging from subtidal to pickleweed-dominated salt marsh. The majority of this restored habitat, approximately 450 acres, is proposed for cordgrass-dominated salt marsh habitat. If the ponds were to be breached with no changes to the current pond elevations, the restored ponds would be expected to support approximately 300 acres of intertidal mudflats, 230 acres of pickleweed-dominated salt marsh, and 115 acres of cordgrass-dominated salt marsh. The approximately 270 acres of unbreached ponds would be retained as managed water areas, with approximately 40 acres to be maintained at salinity levels that support brine invertebrate production.

Following the conversion of the majority of the ponds to tidal influence, invertebrate species richness and abundance would be expected to increase within the breached ponds, while the high biomass of brine invertebrates, including brine flies and brine shrimp, currently available in many of the ponds would shift to the 44-acre area designated for brine management. There is not sufficient data available to predict how this shift in prey availability might affect avian diversity and abundance in San Diego Bay.

Based on observations of shorebird use in salt ponds throughout the world (*Stadtlander and Konecny 1994, Warnock et al 2002*), it appears that migratory bird use of salt ponds is generally higher during high tide than during low tide. This is attributed to the fact that the ponds provide protected loafing areas during high tide (*Stadtlander and Konecny 1994*) and can also provide additional foraging opportunities when extra foraging time is need to recover from migration (*Velasquez 1992*). Conversion of the salt ponds to various intertidal habitats would continue to provide opportunities for protection from the high tides, as would those ponds that are retained for water management. The water levels in the managed pond could also be controlled to provide opportunities for extra foraging time for shorebirds during pre- and post-migration periods.

Phalaropes, eared grebes, and American avocets tend to be abundant within the salt ponds during both high and low tide and could be displaced as a result of a reduction in the widespread availability of brine invertebrates. The effects of displacement could be reduced by the proposal to provide approximately 44 acres of brine ponds that would be managed to optimize conditions for the production of brine invertebrates. As discussed in Alternative C, phalaropes and eared grebes have been described as "behaviorally flexible" (*Jehl 1988*). It is therefore possible that these species would adapt to proposed changes in the availability of brine invertebrates and continue to stop at the salt ponds during migration. It is also possible that these species would change their migration pattern and select an alternative stop over site such as the Salton Sea. The loss of these species from the South Bay would have an adverse effect on the overall avian abundance within the Refuge, but would not be expected to represent a significant adverse effect to the overall population of eared grebes, northern phalaropes, or Wilson's phalaropes.

Potential effects to waterfowl as a result of pond breaching are described in Alternative C. Waterfowl seeking safe, calm water loafing areas often settle in the existing salt ponds. Once the ponds are breached, these waterfowl would likely relocate to the bay or to the managed water area proposed under this alternative. Many of the ponds that currently

support hypersaline conditions and are rarely used by waterfowl would be integrated into the managed pond system. Here, bay water would be circulated through the ponds and a variety of water levels would be maintained to optimize conditions for waterfowl and shorebirds.

The current conditions in the ponds provide little benefit for foraging seabirds. Breaching the ponds would increase fish diversity and abundance in the primary pond system and reintroduce fish into the secondary ponds, thus increasing prey availability of seabirds and other waterbirds. Herons, egrets, and terns could also benefit from increased fish densities in the vicinity of the discharge point for the brine management area, as the high density of brine shrimp in the discharged water would be expected to attract an abundance of fish.

The potential effects to nesting seabirds as a result of breaching the ponds would be similar to those described for Alternative C. As proposed for Alternative C, the level of activity and composition of species within the nesting colonies would be monitored prior to and after completion of the proposed restoration to document any changes in nesting patterns that might occur. Appropriate measures, as described in Alternative C, would be implemented to address any changes in seabird nesting use.

To minimize the potential for adverse effects related to long-term erosion of the levees, which support seabird nesting, this alternative includes a monitoring and maintenance component that would require periodic monitoring of levee integrity and the implementation of measures to reduce erosion of the levees over time. Control of vegetation growth on the levees would also be provided and would focus on removal of non-native species and maintenance of native vegetation to retain access to the shoreline by western snowy plover chicks and maintain open views of the areas surrounding the levees for nesting seabirds.

The effects to land birds as a result of implementing this alternative would be the same as those described under Alternative C.

Public Use

The potential effects to avian species as a result of recreational boating and fishing within the bay would be the same as those described under Alternative A and B. The potential adverse effects related to shoreline fishing on the northern levee of Pond 11 would not occur under this alternative, as no public access would be permitted on this levee under this alternative.

The potential effects of implementing regular guided nature tours along the restored salt ponds and developing an environmental education program adjacent to Bayside Elementary School would be similar to those described under Alternative C.

As described in detail under Alternative C, human activity in proximity to foraging and loafing birds, particularly shorebirds and waterfowl, reduces foraging time for these birds and can result in the unnecessary expenditure of energy when birds are flushed due to disturbance. To reduce the potential for disturbance, the majority of the opportunities for wildlife observation and photography and environmental interpretation to be provided under this alternative would be located around the perimeter of the Refuge rather than dispersed throughout the Refuge. Proposed observation sites and interpretive areas have been sited away from locations that support an abundance of migratory bird foraging and

loafing; therefore, disturbance from human activity in the vicinity of most interpretive elements is expected to be minimal.

The interpretive trail proposed for the perimeter of Pond 28 could result in some disturbance to foraging and loafing birds during low tide, however, the level of use on this trail is not expected to be high, therefore, any adverse effects to shorebirds and other waterfowl is not expected to be significant. To ensure that disturbance impacts are minimal, use of the trail would be monitored periodically during fall and spring migration. If disturbance levels are found to be higher than anticipated, use of the trail would be regulated in a manner that would reduce disturbance to an acceptable level. Various approaches could include closing the trail during fall and spring migration, closing the trail during low tide, or only permitting trail use on weekends. The specific approach would be determined based on the level of disturbance identified.

The construction of an elevated observation platform at the end of 13th Street could result in potentially adverse effects to colonial nesting seabirds if the design and height of the structure were to provide perching opportunities for avian predators. To avoid such adverse effects, measures to prevent avian perching would be incorporated into the final design of the observation platform.

The potential effects of designating and constructing the Otay Valley Regional Trail within the Refuge would be the same as those described in Alternative C.

4.4.2.4.2 Effects to Fish

Habitat and Wildlife Management/Public Use

The Refuge operation activities and public uses proposed under this alternative would provide no new benefits or result in any adverse effects to fish populations within the Refuge.

Habitat Enhancement and Restoration

The potential adverse and beneficial effects to the fish as a result of restoring the Otay River floodplain under this alternative would be the same as those described for Alternative C.

Pond breaching under this alternative would result in a maximum salinity of approximately 120 ppt in the South Bay during the first ebb tide. Increased salinities would generally be contained from the Chula Vista Wildlife Reserve south and would range from about 50 ppt in the area immediately to the west of the Reserve to 120 ppt to the southwest of the Reserve. The salinities in this area would vary with the tides and would be reduced with the high tide. The maximum salinities would decrease to approximately 60 ppt one day after breaching. The short-term effect of extreme salinities on the fish population in the South Bay could be the loss of some eggs, larvae, and/or young of the year and possibly the loss of some adult fish. More likely, this fluctuation in salinity levels would displace some species of fish for several days until salinities in the South Bay stabilize. The potential for some loss of fish and the temporary displacement of other fish would have no significant long-term adverse effects on fish diversity or abundance within the Bay. Restoring approximately 650 acres of intertidal habitat within the salt pond complex would however provide significant long-term benefits to fish populations within the Refuge and throughout the South Bay.

The incidental loss of fish that currently occurs when fish are trapped within the solar salt ponds would not occur once commercial salt production ceases on the Refuge; however, as bay water is drawn into the managed water ponds within the restored salt works, some fish would probably become trapped within the ponds. The salinities in these ponds are not expected to be high enough to result in fish mortality, but trapped fish could become easy prey for fish eating birds. A few fish could also be introduced into the brine management area as a result of transferring water from the managed ponds into these higher salinity ponds. It is unlikely that any fish could survive in these hypersaline ponds. To reduce the potential for fish loss within the managed water areas, fish screens would be installed at the initial bay water intake point in an effort to keep fish out of the managed water areas. The implementation of this measure would reduce potentially significant adverse effects to fish to below a level of significance.

4.4.2.4.3 Effects to Invertebrates

Habitat and Wildlife Management/Public Use

The management and public use proposals included under this alternative would not result in any significant adverse or beneficial effects to invertebrates occurring on the Refuge.

Habitat Restoration

The potential adverse and beneficial effects to invertebrates as a result of restoring the Otay River floodplain under this alternative would be the same as those described for Alternative C.

Pond breaching under this alternative would result in a maximum salinity of approximately 120 ppt in the South Bay during the first ebb tide. The salinities in this area would vary with the tides and would be reduced with the high tide. The maximum salinities would decrease to approximately 60 ppt one day after breaching. The short-term effect of extreme salinities on marine and estuarine invertebrates could be the loss of adult organisms, eggs, or larvae in those areas were salinity levels are the highest. Although some loss of invertebrate populations could occur, the effect would be temporary and recolonization would be expected to occur almost immediately after the salinity levels return to normal. Therefore, no adverse effects to the overall population levels of invertebrates within the bay would be expected. The benefits to marine and estuarine invertebrates as a result of breaching the salt ponds would be similar to those described under Alternative C, however, under this alternative, additional habitat would be available for the reintroduction of these species into the south end of the Bay. Many of the ponds that are too high to be restored to tidal action would be maintained as managed water areas in which bay water would be circulated through the ponds and water levels would be manipulated as appropriate throughout the year to support waterfowl, shorebirds, and other water birds. The primary intent of this component of the restoration proposal is to provide additional habitat for benthic invertebrates, which would in turn provide additional foraging habitat for migratory birds. Although many of the benthic invertebrates that become established within these ponds would be preyed upon by migratory birds, there would still be a moderate benefit to these organisms from the new habitat provided within the managed bay water ponds. The hypersaline ponds of the brine management area however would continue to provide limited if any habitat for marine and estuarine invertebrates.

As a result of restoring tidal influence to the ponds within the upper end of the primary pond system, as well as within much of the secondary pond system, the total biomass of brine invertebrates currently supported within the salt pond system would be greatly

reduced. To minimize potential adverse effects associated with the elimination of brine invertebrate production within the restored system, approximately 45 acres of managed pond area would be maintained at salinity levels appropriate for brine invertebrate production. The indirect effects of reducing the availability of brine invertebrates on avian species were addressed previously in Section 4.4.2.3.1.

4.4.2.4.4 Effects to Amphibians and Reptiles

Habitat and Wildlife Management/Public Use

No effects to these organisms would be expected as a result of implementing the management activities and public uses proposed under this alternative.

Habitat Restoration

Restoration of the salt works would have no effect on these organisms. The potential effects of restoring the Otay River floodplain on amphibians and reptiles would be the same as those described for Alternative C.

4.4.2.4.5 Effects to Mammals

Habitat and Wildlife Management/Public Use

With the exception of predator management, which is addressed under Sweetwater Marsh Unit, Alternative A, the management activities and public uses proposed under this alternative would result in any adverse or beneficial effects to these organisms.

Habitat Restoration

No effects to mammals would result from restoring the salt ponds and the effects of restoring the Otay River floodplain would be the same as those described in Alternative C.

4.5 Effects to Endangered and Threatened Species

The direct, indirect, and cumulative effects to endangered and threatened species as a result of implementing the various alternatives are described below. An adverse effect to endangered and threatened species would be considered significant if:

- An action would result in the direct mortality or habitat loss, lowered reproductive success, or habitat fragmentation of a federally or state listed plant species.

- Permanent loss of occupied listed species habitat, substantial loss of foraging or nesting habitat for a listed species, or the direct mortality of individuals of a listed species would occur as a result of a proposed action.

An indirect beneficial impact would occur if an action would result in the creation of substantial new areas of foraging, roosting, or nesting habitat for listed wildlife species, or substantial new areas of habitat appropriate to support listed plant species. A significant cumulative impact would result from habitat modifications effecting listed species that would be considered minor for the proposed action but would be significant when considered in light of other similar losses within the region.

4.5.1 Sweetwater Marsh Unit

4.5.1.1 Alternative A – No Action

Habitat and Wildlife Management/Public Use Program

The continuation of current management activities including predator management, as described in Section 4.4.1.1, would provide significant benefits to the Refuge's endangered

and threatened species by maintaining the quality of the existing habitats and reducing the loss of these species to mammalian and avian predators. Benefits would result from annual nest site preparation at the D Street Fill to optimize nesting conditions for the California least tern and western snowy plover; monitoring of terns and plovers during the nesting season; and predator management to protect least tern, snowy plover and light-footed clapper rail adults, chicks, and eggs. Nest site preparation would involve vegetation management in the form of site disking and examination and, where necessary, repair of existing fencing and regulatory signage prior to the nesting season. No impacts to endangered species would result from this activity as it occurs in advance of the first observations of terns or plovers to the site.

Endangered species monitoring would also continue as described previously. Temporary disturbances to nesting birds could occur during monitoring (refer to Section 4.4.1.1); however, monitoring protocols are implemented to reduce the potential for such adverse affects. As a result, the benefits of the data provided as a result of monitoring outweigh the minor temporary adverse effects that occur during monitoring. In addition, on-site monitoring facilitates timely adaptive management (e.g. predator management, prosecution of trespassers, etc.) (*Patton 2002*). If during monitoring it is determined that disturbance impacts are becoming a threat to the nesting birds, the existing protocols would be reevaluated and additional measures such as greater use of blinds; further limiting the time spent in the colony; and/or scheduling monitoring activities to avoid periods of increased disturbance from other sources, such as adverse weather conditions or the presence of potential predators, would be implemented.

The depredation of California least terns by mammalian and avian predators was the primary limiting factor to the reproductive success of this species throughout its range in 2000, with 19 species documented preying on least terns during that year (*Patton 2002*). At the D Street Fill, six species were considered possible predators in 2000; one of these, a northern harrier, was observed preying on tern chicks. Northern harriers were also observed preying on tern chicks in 2001 and on an adult tern in 2002. Other losses of chicks and eggs have been documented that are attributed to predation; however, the responsible species was not identified. The implementation of predator management is intended to reduce the adverse effects of predation and increase the reproductive success of this species and the western snowy plover, which suffers similar effects from predation.

Restoration of mitigation leasehold overlay on the D Street Fill by the leaseholder or cooperating third party could also benefit the endangered light-footed clapper rail by providing additional foraging and nesting habitat to support this species. Restoration of the upland areas on Gunpowder Point could benefit the threatened California gnatcatcher by providing habitat known to support the foraging and nesting requirements of this species.

Continuing to implement the current public use program on this Refuge Unit could result in occasional inadvertent or deliberate off-trail activity. Such activity could have an adverse effect on salt marsh bird's beak, which occurs in the drier upper marsh elevations that are more likely to be impacted by unauthorized pedestrian access. Field observations indicate that even a moderate amount of foot traffic can damage the fragile seedlings (*USFWS 1985*), resulting in decreased population numbers. Under this alternative, no changes to the existing trail system are proposed; therefore, the potential remains for some direct impacts to this species.

4.5.1.2 Alternative B – Habitat Enhancement/Implementation

Habitat and Wildlife Management/Public Use Program

The beneficial effects to endangered and threatened species as a result of the predator management activities proposed under this alternative would be the same as those described under Alternative A. In addition, this alternative proposes to expand the marsh management activities currently occurring on the Refuge to include expanded invasive species control and increased enforcement of unauthorized access into the marsh. These actions are expected to improve habitat quality for the Refuge's population of salt marsh bird's beak.

This alternative includes no proposals to increase the number of uses occurring on the Refuge, nor does it propose the expansion of any current uses. Therefore, no new beneficial or adverse effects related to public use would occur under this alternative. The potential for impacts to salt marsh bird's beak from off-trail activities related to the use of the existing trail system on Gunpowder Point, as described for Alternative A, would also be realized under this alternative.

Habitat Enhancement

The enhancement actions proposed under this alternative would provide some improvements to the quality of the nesting habitat for the California least tern and western snowy plover on the D Street Fill. The quality of foraging habitat for the light-footed clapper rail within the marsh complex would also be improved. Specifically, the actions proposed to improve tidal circulation within the marsh complex would indirectly benefit the light-footed clapper rail as channel sedimentation would decrease and, in some cases, be reversed to improve conditions for the establishment of cordgrass.

The potential for adverse effects to endangered and threatened species during grading would be avoided by controlling the level of construction activity permitted in the vicinity of active nest areas, including restricting some activities to the non-breeding season; establishing construction boundaries that minimize impacts to native vegetation and sensitive habitat areas; and monitoring sensitive habitat areas located adjacent to construction activity to assess actual disturbance levels and, where necessary, develop and implement additional protective measures.

4.5.1.3 Alternative C –Habitat Restoration/Enhance Public Use (Preferred Alternative)

Habitat and Wildlife Management/Public Use Program

Salt marsh bird's beak would benefit from the further expansion of management actions included under this alternative to improve propagation of this species on the Refuge. In addition, the proposal to redesign the existing trail system would provide opportunities for reducing potential impacts to this species from unauthorized off-trail activities.

Habitat Restoration

Many of the benefits to endangered and threatened species described in Alternative B would also be realized under Alternative C. The potential adverse effects to these species during construction would be minimized as described in Alternative B. Under this alternative, the California least tern and western snowy plover could benefit by the proposal to retain approximately 10 more acres of the D Street Fill for nesting area than is proposed under the current MOU for the mitigation leasehold overlays. This benefit would only be realized if the area is not restored prior to the expiration of the overlays in 2010. While terns and plovers could benefit from this proposal, the light-footed clapper rail

would not realize the potential benefits that would be provided by restoring 23 versus 13 acres of additional intertidal habitat at the D Street Fill.

4.5.2 South San Diego Bay Unit

4.5.2.1 Alternative A – No Action

Habitat and Wildlife Management/Public Use Program

The continuation of current management activities, as proposed under the No Action Alternative, would provide no new benefits and result in no adverse effects to the endangered and threatened species supported on the Refuge. However, the implementation of nesting and foraging enhancements, as required in the Cooperative Agreement between the Port and the Service, would provide benefits to the endangered California least tern by improving nesting conditions along the salt pond levees and providing additional foraging opportunities in proximity to these improved nesting areas.

The implementation of least tern and snowy plover monitoring during the nesting season would result in effects similar to those described for monitoring under Sweetwater Marsh Unit, Alternative A. The No Action Alternative also proposes to implement the predator management activities described in Alternative A for the Sweetwater Marsh Unit to protect the endangered California least tern and light-footed clapper rail and the threatened western snowy plover. In 2000, 12 species were identified as possible predators of least terns at the salt works. Of the 12, five species were documented as preying on eggs, chicks, and/or adult least terns. Twenty-one eggs, one chick, and 13 nests were documented as lost to predation, although the species responsible for predation could not always be identified. Predator management provides benefits to the least tern and snowy plover by reducing the loss of chicks and eggs to mammalian and most avian predators and increasing the potential for reproductive success.

The current predator management plan does not include a proposal to address the loss of terns and plovers that result from predation by gull-billed terns, which also nest at the salt works. Therefore, adverse effects to these species as a result of gull-billed tern predation would continue. The Refuge Manager would continue to work with the Service's Migratory Birds Program to address issues related to gull-billed tern predation of listed species.

Under all of the alternatives proposed for the South San Diego Bay Unit, the California brown pelican would be expected to benefit from the continued maintenance of isolated roosting habitat within the Refuge. This roosting habitat includes the levee between Ponds 10 and 11 and a floating platform that has been installed within the salt works. The floating platform was installed to provide an additional isolated night roosting area for pelicans. Monitoring is currently being conducted to determine the actual use of the platform by pelicans. If monitoring results demonstrate positive benefits to the pelican, up to two additional floating platforms could be installed within appropriate salt ponds. Increasing the availability of isolated roosting areas for the pelican within the bay is expected to benefit this endangered species by reducing the travel distance between prey sites and roost sites, as well as reducing human and mammalian disturbance. This proposal, which would contribute to the increased availability, quality, and capacity of stopover sites within the flyway, could also positively influence the energy associated with migration. The placement of these platforms within various salt ponds, which was previously reviewed in accordance with NEPA, is not expected to adversely affect the nesting or foraging activities of the other endangered or threatened species found on the Refuge.

Boating and fishing within the open waters of the South San Diego Bay Unit could result in disturbance related impacts to the endangered California brown pelican and the threatened Pacific green sea turtle. An additional impact associated with fishing results of the inappropriate discarding of fishing line into the bay. Entanglement with fishing line results in death of many birds in the South San Diego Bay, as documented by Service field staff. Species affected include the California brown pelican, California least tern and western snowy plover. Boat propellers could also pose a hazard to turtles that happen to surface in path of oncoming boats. Stinson (*1984*) noted that turtles do not increase their speed when followed by a boat and have been observed to surface within six feet of a boat even when the motor was running. Enforcement of the 5 mph speed limit in this area would reduce the potential for impacts to turtles from boating activity.

Occasional guided tours on the salt works are not expected to result in any adverse impacts to listed species because tours would not be conducted during the nesting season. In addition, to protect wintering snowy plovers, all tours would be supervised to ensure that inappropriate access onto sensitive habitat areas would not occur.

4.5.2.2 Alternative B –Enhance Nesting Habitat

Habitat and Wildlife Management/Public Use Program

The effects of implementing predator management and maintaining pelican roosting areas under this alternative would be the same as those described for Alternative A. The management actions proposed under this alternative would provide no new benefits for the light-footed clapper rail, but could reduce disturbance to the California brown pelican and green sea turtle as a result of increased enforcement of the established speed limit within the Refuge's open water areas. Losses and/or injuries to terns, plovers, and pelicans caused by entanglement in discarded fishing line could be reduced through proposed implementation of an outreach program intended to reduce the accumulation of discarded fishing line within the South Bay.

The potential for adverse effects from boating and fishing on the bay, which would continue to be permitted within the Refuge under this alternative, would be the same as those described under Alternative A. No new uses are proposed under this alternative.

Habitat Enhancement

The majority of the habitat enhancements proposed under this alternative (e.g. nesting substrate enhancement, creation of new nesting areas) are intended to increase California least tern and western snowy plover fledging success. In addition, the recontouring the levee slopes would provide young plover chicks with easier access to the edge of the salt ponds, thus enhancing their foraging opportunities. Additional nesting opportunities are also proposed for plovers through the management of the water level within Pond 20. The water level in this pond would be lowered during the nesting season to provide plovers with dry areas suitable for nesting. These actions in combination with ongoing predator management could provide potentially significant cumulative benefits in terms improved fledging success for both the least tern and the snowy plover.

No new benefits to the light-footed clapper rail would be realized under this alternative, as it lacks any proposals to restore cordgrass-dominated salt marsh habitat.

4.5.2.3 Alternative C – Enhance and Restore Habitat/Expand Public Uses

Habitat and Wildlife Management/Public Use Program

The benefits of predator management to the California least tern, western snowy plover, and light-footed clapper and the benefits to pelicans from the maintenance of roosting platforms would be the same as described previously. No adverse effects to endangered or threatened species are expected as the result of implementing any of the other management activities proposed under this alternative.

Boating and fishing on the bay would also continue to be permitted under this alternative, therefore, the impacts to listed species from these uses, as described for Alternative A, would also occur under this alternative. Opening the northern levee of Pond 11 to public access for fishing and wildlife observation would increase human activity in proximity to existing and proposed light-footed clapper rail habitat. The major threat to light-footed clapper rails from this increase in human activity involves the potential for direct habitat or nest losses through trampling of cordgrass or pickleweed where nests could occur. Clapper rails are not as prone to reacting to the presence of humans in the vicinity of their habitat as are other bird species; however, foraging opportunities may be disrupted if humans are present for long periods in clapper rail territories. Frequent disturbance could cause the rails to abandon the area in search of more suitable habitat. The level of impact to this species as a result of this proposal would depend upon the final design of the fishing and wildlife observation facilities that are provided, as well as the measures that are incorporated into the design to minimize such impacts.

The State listed endangered Belding's savannah sparrow occupies the high marsh habitat that occurs along the slopes of the Pond 11 levee, as well as in the adjacent South Bay Biological Study Area. The quality of this habitat could be reduced as a result of direct loss of vegetation through trampling, as well as by frequent disturbance to the birds. Trash and discarded fishing line also represent a threat to these species.

Appropriate siting of environmental education activities outside of sensitive areas and adequate Refuge oversight and supervision of these activities would avoid any potential for adverse effects to listed species. Interpretive elements proposed along the Bayshore Bikeway would occur outside of the boundaries of the marsh; therefore, the potential for impacts to clapper rails and other listed species would be minimal. Regular guided tours of the salt works area would not be expected to result in any adverse impacts to listed species because tours would not be conducted during the nesting season. Adverse impacts to clapper rails as a result of the extension of the Otay Valley Regional Trail along the eastern perimeter of the Refuge would be minimized through appropriate fencing and signage.

Habitat Enhancement and Restoration

The nesting enhancements proposed for Alternative B would also be implemented under this alternative; therefore, similar benefits to the California least tern and western snowy plover, as described under Alternative B, would also occur under Alternative C.

The restoration proposals included in this alternative would substantially expand the total acreage of suitable habitat for the light-footed clapper rail in the South Bay. The restoration of up to 325 acres of cordgrass-dominated salt marsh habitat within the Refuge including approximately 25 acres within the Otay River Floodplain and up to 300 acres within the restored salt ponds is expected to provide significant benefits for this species.

Foraging opportunities for the California least tern would also be improved as a result of the salt marsh restoration proposals included under this alternative.

Proposed improvements in the quantity and quality of freshwater wetland habitat within the Otay River floodplain could also benefit the endangered least Bell's vireo and southwestern willow flycatcher by providing new nesting opportunities for these species, which although observed upstream within the Otay River drainage, are not currently supported on the Refuge.

The potential for adverse effects to the Refuge's endangered and threatened species during restoration-related grading activities would be minimized by controlling the level of construction activity permitted in the vicinity of active nest areas, including restricting some activities to the non-breeding season; establishing construction boundaries that minimize impacts to native vegetation and sensitive habitat areas; and monitoring sensitive habitat areas during construction to assess actual disturbance levels and, where necessary, develop and implement additional protective measures. Removing individual rails from the area and maintaining them at an appropriate facility until they can be safely released back into the restored habitat would avoid direct impacts to the light-footed clapper rail as a result of implementing restoration activities in the Otay River floodplain.

4.5.2.4 Alternative D - Maximize Habitat Restoration/Moderately Increase Public Uses (Preferred Alternative)

Habitat and Wildlife Management/Public Use Program

Benefits to the California least tern, western snowy plover, and light-footed clapper rail from predator management would be the same as described previously. Pelican roosting platforms would continue to be maintained on the Refuge, but may be moved from the salt ponds to the open bay. In addition, Refuge management activities would be expanded under this alternative to ensure the continued isolation of the salt pond levees following the closing of the commercial solar salt operation. Activities would include the installation of perimeter fencing around the eastern end of the salt ponds and an increased presence of Refuge personnel at the site. These actions would minimize increases in unauthorized access onto the salt ponds and reduce the potential for human disturbance that could adversely affect sensitive species. No adverse effects to endangered or threatened species are expected as the result of implementing any of the management activities proposed under this alternative.

The northern levee of Pond 11 would not be opened under this alternative; therefore, the potential adverse effects of opening the levee would be avoided under this alternative. The effects of conducting regular tours of the salt works, extending the Otay Valley Regional Trail onto the Refuge, and creating an environmental education program would be the same as those described in Alternative C. The development of an interpretive program and wildlife observation areas along the perimeter of the Refuge would be adequately separated from habitats that support listed species; therefore, no impacts related to human disturbance are anticipated. Observation platforms would be designed to avoid the creation of potential perching sites to avoid creating potential impacts to new nesting areas, such as Pond 20, which would be managed to support western snowy plover nesting.

Habitat Enhancement and Restoration

All of the benefits to endangered and threatened species described in Alternative C would also be realized under Alternative D, with potentially greater benefits to the light-footed clapper rail as the result of additional restoration of habitat known to support this species.

The measure described under Alternative C to avoid or minimize impacts to endangered and threatened species during restoration would also be implemented under this alternative.

4.6 Effects to Cultural Resources

The National Historic Preservation Act (NHPA) of 1966, as amended, establishes the federal government's policy on historic preservation and the programs through which that policy is implemented. Relevant policies on historic preservation and associated programs, including the National Register of Historic Places (NRHP), were described previously in Section 3.5. According to the NHPA, historic properties include "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places" (16 USC 470w (5)). The criteria used to evaluate eligibility are presented in Section 3.5 of this document.

Section 106 (16 USC 470f) of the NHPA requires federal agencies, prior to taking action, to take into account the effects of their undertaking on historic properties. Specific regulations regarding compliance with Section 106 state that although the tasks necessary to comply with Section 106 may be delegated to others, the federal agency is ultimately responsible for ensuring that the Section 106 process is completed according to statute. The Section 106 process has four basic steps:

- Identify and evaluate historic properties;
- Assess adverse effects of the project on historic properties;
- Resolve any adverse effects of the project on historic properties in consultation with the SHPO/Tribal Historic Preservation Officer (THPO), and other interested parties, resulting in a Memorandum of Agreement (MOA); and
- Proceed in accordance with the MOA.

To determine if a proposed action could impact a cultural resource, it is necessary to conduct a survey of the Area of Potential Effects (APE) or if a survey has been previously conducted, to review the results of that survey and determine if any resources identified are eligible for inclusion in the NRHP. The APE is defined as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties. It is not necessary to know that the area in question contains historic properties, or even to suspect that such properties exist, in order to determine the APE. The APE is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking. In addition, the APE is not always a contiguous area; there may be multiple alternative project sites or multiple areas in which changes are anticipated. The APE for the San Diego Bay CCP is illustrated in Figure 3-1. A number of actions are proposed to implement the CCP. Each action would have its own project specific APE. For example, the APE for the restoration of the salt works under Alternative C would include those ponds and associated levees proposed for restoration. If fill from the Otay River floodplain is required to implement the pond restoration, the area of excavation and any construction routes or staging areas would also be included in the APE.

As described in Section 3.5, surveys have previously been conducted for various portions of the APE and cultural resources have been identified. Of the resources identified, some have been deemed ineligible for inclusion in the NRHP, while others are considered eligible. In addition, several known resources have yet to be evaluated. There are also areas within the APE that have yet to be surveyed to determine the presence or absence of cultural resources. Surveys of these areas and determinations of eligibility for any features that have not yet been evaluated would be required prior to the implementation of any ground-disturbing or other activities that may affect historic resources.

An impact to cultural resources would be considered significant if it adversely affects a resource listed in or eligible for listing in the NRHP. In general, an adverse effect may occur if a cultural resource would be physically damaged or altered, isolated from the context considered significant, affected by project elements that would be out of character with the significant property or its setting. Title 36 CFR Part 800 defines effects and adverse effects on historic resources as follows:

> Section 800.5(1) Criteria of Adverse Effects. An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the NRHP in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the NRHP. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.
>
> Section 800.5(2) Examples of Adverse Effects. Adverse effects on historic properties include, but are not limited to:
>
> (i) Physical destruction, damage, or alteration of all or part of the property;
> (ii) Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation and provision of handicapped access, that is not consistent with the Secretary's Standards for the Treatment of Historic Properties (36 CFR part 68) and applicable guidelines;
> (iii) Removal of the property from its historic location;
> (iv) Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance;
> (v) Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features;
> (vi) Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and
> (vii) Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

Cumulative impacts to cultural resources could result from individually minor but collectively significant actions taking place over a period of time. Cumulative effects often occur to districts, where several minor changes to contributing properties, their landscaping, or to their setting over time could result in a significant loss of integrity (*City of San Diego 2004*).

4.6.1 Sweetwater Marsh Unit

4.6.1.1 Effects Common to All Alternatives

Several historic resources have been identified within the boundary of the Sweetwater Marsh Unit. Of these resources, all but one have been evaluated and determined to be ineligible for inclusion to the NRHP. One known resource, the Hercules Powder Company site that is located on Gunpowder Point, has not yet been evaluated. Because this resource has not yet been evaluated, measures would be implemented to maintain site integrity.

When a new project is proposed on the Sweetwater Marsh Unit that would involve earth moving or other ground disturbing activities, a review of the previous survey results would be conducted and consultation completed with SHPO and interested parties.

4.6.1.2 Alternative A – No Action

There is a potential for adverse effects to the Hercules Powder Company under existing conditions because of the proximity of the resource to public use areas. Post and cable fencing has been provided along both sides of the existing trail to reduce this potential for intentional or inadvertent impacts to site resources.

In addition, to raise awareness of the need to protect what remains of this site, interpretation of the site's history is provided on signs located along a portion of the trail.

No new management activities are proposed under Alternative A that could compromise the integrity of the Hercules Powder Plant site; however, there is the potential for habitat restoration on Gunpowder Point that may affect this resource. Gunpowder Point is one of several mitigation leasehold overlays that are currently available for restoration in accordance with the Settlement Agreement described in Section 2.2.2.1. To avoid adverse effects to cultural resources as a result of future restoration, a cultural resource survey would be conducted prior to implementing any restoration activities. Any new cultural resources identified during the survey, as well as the Hercules Powder Plant site, would be recorded and evaluated for eligibility to the NRHP. Once this work is completed, additional measures may be required depending upon the results of the eligibility determination. If any sites are determined to be eligible to the NRHP, the restoration plans would need to be assessed for potential effects to the historic property. If effects are possible, the proposal would be reviewed to ensure that the effects have the least impact to original materials and are in conformance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. Changes that comply with the Secretary's Standards would have no adverse affect on historic properties. Once an assessment has been completed, the findings would be forwarded to SHPO for concurrence. Where removal or major alteration of the property would occur, mitigation would be developed and stipulated in a Memorandum of Agreement (MOA) with SHPO and the Advisory Council on Historic Preservation. Other interested parties, such as the Chula Vista and/or San Diego Historical Society and the Save Our Heritage Organisation (SOHO), would likely be interested parties in this process and would be invited to participate in the MOA.

Although all of the previously recorded archaeological sites were determined to be ineligible, earth moving activities occurring in proximity to these sites would be monitored because of the potential for buried cultural material in these areas. If any cultural materials are uncovered during excavation, the Regional Historic Preservation Officer would be contacted to review the materials and recommend a treatment that is consistent with applicable laws and policies.

Implementation of the procedures described above is expected to avoid adverse effects to historic resources; however, additional analysis under NEPA may be required once specific details

regarding the historic resources that could be affected and/or the specific actions to be implemented are available.

4.6.1.3 Alternative B – Habitat Enhancement/Interpretation

The potential effects to cultural resources described under Alternative A would also occur under Alternative B; therefore, the measures described above for determining and addressing adverse effects would also apply to Alternative B.

The enhancement projects proposed under this alternative (refer to Figure 2-3) would not be expected to have an adverse effect on historic resources. However, because portions of the area surrounding the old roadbed to the east of Gunpowder Point could contain buried cultural material, the excavation and removal of the old roadbed would be monitored. If any cultural materials are discovered, the Regional Historic Preservation Officer would be contacted to review the materials and recommend a treatment that is consistent with applicable laws and policies.

Implementation of the procedures described above is expected to mitigate any potential adverse effects to historic resources; however, additional analysis under NEPA may be required once specific details regarding the historic resources that could be affected and/or the specific actions to be implemented are available.

4.6.1.4 Alternative C – Habitat Restoration/Enhance Public Use (Preferred Alternative)

The actions described under Alternatives A and B would also be implemented under this alternative. In addition, the excavation associated with salt marsh restoration proposed along the northern edge of Gunpowder Point and upland restoration proposed on Gunpowder Point would be monitored because of the potential for buried cultural material. Any cultural material that is discovered would be handled in accordance with applicable laws and policies.

The redevelopment of the existing trail system on Gunpowder Point could have an adverse effect on the Hercules Powder Company site if the integrity of the site is impacted prior to recordation and determination of eligibility. To avoid this effect, the procedures described under Alternative A for recording the site, determining its eligibility to the NRHP, and evaluating effects to the resource should it be determined to be eligible would also be implemented under this Alternative.

Implementation of the procedures described above is expected to avoid any potential adverse effects to historic resources; however, additional analysis under NEPA may be required once specific details regarding the historic resources that could be affected and/or the specific actions to be implemented are available.

4.6.2 South San Diego Bay Unit

4.6.2.1 Effects Common to All Alternatives

Historic resources have been identified within the boundary of the South San Diego Bay Unit including the "Western Salt Company Salt Works," which was determined to be eligible for the NRHP in 2001. The designation is based on the high degree of integrity of the salt ponds as representative of the solar salt industry during the period from 1916 to 1949. Changes to the pond design, use, setting, or function would affect the significant characteristics that have been determined to be eligible to the NRHP. The effects to this historic property would differ depending upon which alternative is implemented, as described below.

Cultural resource surveys have also identified prehistoric archaeological sites along the bayfront shoreline and within the Otay River floodplain. The amount of activity and the importance of shell

and marine resources to Native populations indicate that new site discoveries may occur within the boundaries of this Refuge Unit. A cultural resource survey would be conducted within the Otay River floodplain and along the southern edge of the salt ponds prior to initiating any actions that require excavation. All new sites and any previously recorded sites would be evaluated to determine eligibility to the NRHP prior to implementing actions that could affect these resources.

Eligible and potentially eligible resources could be directly affected by ground-disturbing activities associated with habitat enhancement and restoration, levee modifications, changes in the operation of the salt works, and facilities construction. Public access into areas that include cultural resources could also result in adverse effects to these resources.

4.6.2.2 Alternative A – No Action

No changes to the overall use, function, design, or setting of the salt works is proposed under this alternative. Some minor changes to the salt works could occur to facilitate the continuation of the salt operation or to facilitate on-going habitat management activities. Although these changes would affect the resource, they are relatively minor and would not be considered an adverse effect. This is because the primary character defining feature of the salt works is the functioning industrial landscape with each of the key steps in the solar salt process illustrated. Elements of the landscape that are clearly associated with the salt works operation are the continuously changing piles of salt near the processing plant, the division of the ponds, and the various levels of pond salinity and production. The minor changes that could occur under this alternative would not alter the relationship, configuration, design, and/or function of the salt works, and would not diminish the property's historic character. Such changes would meet the criteria finding for a No Adverse Effect. Further, only limited public access is currently permitted within the salt works and the Otay River floodplain; therefore, no adverse effects to cultural resources as a result of human activity within the Refuge Unit are anticipated.

Based on the criteria for assessing adverse effects that are provided in the NHPA, Alternative A is considered to be a "No Adverse Effect" undertaking as per 36 CFR Part 800.5(3)(b). The Service's determination of no adverse effect would be submitted to SHPO for concurrence. No mitigation would be required.

4.6.2.3 Alternative B – Enhance Nesting Habitat

This alternative proposes minor modifications to the salt pond levees to better accommodate nesting seabirds. In addition, new nesting areas would be provided within the salt works by adding limited areas of fill within some ponds. The function of the levees and ponds would remain unchanged and only minor changes in the appearance of the ponds and levee surfaces and side slopes would occur. Commercial solar salt production would continue and for the most part, the enhancements proposed for the levees would be no different in appearance than that which would result from periodic maintenance conducted in association with the existing solar salt operation. The minor modifications to historic properties proposed under this alternative would meet the criteria of finding for a "No Adverse Effect" undertaking as per 36 CFR Part 800.5(3)(b). The Service's determination of no adverse effect would be submitted to SHPO for concurrence. No mitigation would be required.

The potential effects to cultural resources within the Otay River floodplain would be the same as described under Alternative A.

4.6.2.4 Alternative C – Enhance and Restore Habitat/Expand Public Use

Alternative C proposes to restore native habitat within the Refuge Unit by excavating portions of the Otay River floodplain to restore coastal wetlands and breaching some salt ponds to restore intertidal habitat. Because of the potential for unknown buried cultural resources within the Otay River floodplain, excavation could affect cultural resources. Prior to any excavation, the area of potential effects would be surveyed and any cultural resources identified would be evaluated for eligibility to the NRHP. If effects to an eligible site are possible, the Service would consult with SHPO, federally recognized Tribes, and interested parties. To ensure that no unanticipated effects to cultural resources would occur during excavation, all excavation within the Otay River floodplain would be monitored to ensure that if cultural resources are present, they are treated appropriately. Also prior to excavation, the Service would work with Native American groups to create a Memorandum of Understanding (MOU) to implement the inadvertent discovery clause of the Native American Graves Protection and Repatriation Act (NAGPRA). Development of this MOU would involve identifying the Native American Tribes, Groups, and direct lineal descendants that may be affiliated with these Refuge lands, initiating consultation with the affiliated Tribes, Groups, and/or direct lineal descendants, developing procedures to follow for intentional and inadvertent discoveries, and identifying the persons to contact for the purposes of NAGPRA.

Under Alternative C, a minimum of 200 and a maximum of approximately 440 acres of salt ponds would be taken out of salt production and breached to restore intertidal habitat. The remaining ponds would continue to be used for solar salt production.

Reducing the number of salt ponds by 200 acres (Salt Works Restoration Option 1) would alter the historically intact landscape by eliminating the ponds on the west side of the Otay River. However, under this Restoration Option, a proper balance in the types of ponds representative of the solar salt making process would be retained on the east side of the Otay River and solar salt production would continue under a reduced footprint. Because the character defining features of the South Bay Salt Works include the landscape conformation of levees, ponds, water control structures, roads, and industrial buildings, the character of the salt operation would not be substantially altered by removing the western ponds from salt production. In addition, the overall configuration of the pond levees would be retained, although portions of the levees would be breached to permit tidal exchange within the ponds. Although this Restoration Option would alter a historic property, the historic character and function of the South Bay Salt Works solar salt system would be sustained. Therefore, the proposed modifications to this historic property would meet the criteria of finding for a "No Adverse Effect" (36 CFR Part 800.5(3)(b)). The Service's determination of no adverse effect would be submitted to SHPO for concurrence. The proposed modification to the historic property would be reviewed by SHPO to ensure that the changes have the least impact to original materials and are in conformance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. If SHPO concurs that the changes comply with the *Secretary's Standards*, no mitigation for project effects would be required.

Under Salt Works Restoration Option 2, nearly half the acres involved in salt production would be removed and it is not known if solar salt production would be economically viable within the reduced footprint. Therefore, the implementation of this option would result in a recognizable loss in the use and function of the ponds. Based on the criteria for assessing adverse effects that are provided in 36 CFR 800.5, changing the use of the salt pond would cause a change in the character of the property which contributes to its eligibility (36 CFR 800.5(2)(iv)). Additionally, removing the salt ponds from production would cause a loss of historic materials (36 CFR 800.5(2)(i)). Implementation of Alternative C, Salt Works Option 2 would therefore have an adverse effect on historic properties and mitigation would be required.

Mitigation would be developed and stipulated in a Memorandum of Agreement (MOA) with SHPO and the Advisory Council on Historic Preservation. Other interested parties, such as the Chula Vista and/or San Diego Historical Society and the Save Our Heritage Organisation (SOHO), would likely be interested parties in this process and would be invited to participate in the MOA. A possible mitigation strategy for the South Bay Salt Works would involve recordation through photographs and reprinting historic photographs and interpreting the recorded images for the public. The mitigation or treatment plan would be developed during consultation with SHPO and interested parties. An essential element of the treatment plan would include conveyance of a sense of the original design and function of the solar salt industry to the public.

This alternative also proposes extensive excavation of the Otay River floodplain. Prior to the completion of final restoration plans for this area, the area of potential effect would be identified and a survey of the area would be conducted to record all cultural resources. If cultural resources are identified, their eligibility for inclusion in the NRHP would be assessed, and, if necessary, a treatment plan for mitigating any adverse effects to eligible resources would be prepared. The assessment of project effects, treatment plan, and eligibility determinations would involve consultation with SHPO and other interested parties. If deemed appropriate, the proposed excavation would be monitored to ensure that no buried resources are uncovered during grading. Prior to excavation, Native American Tribes, Groups, and direct lineal descendants that may be affiliated would be identified and a Memorandum of Understanding with the appropriate Native American groups would be created to established procedures for implementing the inadvertent discovery clause of NAGPRA.

4.6.2.5 Alternative D – Maximize Habitat Restoration/Moderately Increase Public Uses (Preferred Alternative)

The implementation of Alternative D would result in the elimination of solar salt production within San Diego Bay. Changing the use of all of the salt ponds would cause a change in the character of the property which contributes to its eligibility as per 36 CFR 800.5(2)(iv) and removing all of the salt ponds from production would also cause a loss of historic material as per 800.5(2)(i). Therefore, elimination of the solar salt production in San Diego Bay would have an adverse effect on historic properties and would require mitigation similar to that described for Salt Works Restoration Option 2 under Alternative C.

The potential effects of this alternative on cultural resources located within the Otay River floodplain would be the same as those addressed under Alternative C.

4.7 Effects to the Social and Economic Environment

4.7.1 Effects to Land Use

This section analyzes the potential land use conflicts between the habitat management and public use proposals presented in each alternative and the existing and planned land uses in the immediate vicinity of the two Refuge Units.

Adverse effects related to land use would be considered significant if:

- Substantial incompatibility between proposed uses or activities and adjacent existing uses would occur.

- Substantial changes in use or the intensity of use are proposed, where the resulting activity or use pattern would create significant noise, traffic, public safety, or similar environment impacts that would adversely affect the existing or future the use of adjacent areas.

4.7.1.1 Sweetwater Marsh Unit

4.7.1.1.1 Alternative A – No Action

No potential land use conflicts to existing or planned uses in proximity to the Refuge are anticipated under Alternative A. Public uses would be maintained at current levels; therefore, no additional traffic would be generated and no increases in the current demand for parking in the area would occur. The majority of the Refuge would continue to be closed to public access; therefore, no disturbance to adjacent properties from human activity would be anticipated.

4.7.1.1.2 Alternative B – Habitat Enhancement/Interpretation

The expansion of current management activities to include improvements to tidal circulation within the marsh complex could result in short term disruptions in public access to the Nature Center, primarily during the installation of an additional culvert under the existing access road. Working with the Nature Center staff to schedule construction during historically slower times during the week would minimize this impact. No other land use conflicts are anticipated under this alternative.

4.7.1.1.3 Alternative C –Habitat Restoration/Enhance Public Use (Preferred Alternative)

The restoration proposals included under this alternative would not result in any conflicts to existing or future land uses in the vicinity of the Refuge. Habitat restoration on Gunpowder Point, as well as the redesign of the existing trail system, could result in some disruption to public access, temporarily interrupting visitor use of the trail. To minimize this effect, some level of trail access would be provided during restoration and new trail construction.

4.7.1.2 South San Diego Bay Unit

4.7.1.2.1 Alternative A – No Action

No potential land use conflicts are anticipated under this status quo alternative in regards to existing uses or uses that would be permitted in proximity to the Refuge. Nuisance effects to adjacent uses related to occasional odors generated from the salt ponds would continue (refer to Section 4.7.5.2). Public uses would be maintained at current levels; therefore, no additional traffic would be generated and no increases in the current demand for parking in the area would occur. The majority of the Refuge would continue to be closed to public access; therefore, no disturbance to adjacent properties from human activity would be anticipated.

4.7.1.2.2 Alternative B - Enhance Nesting Habitat

No land use conflicts would be expected as a result of implementing the nesting enhancement proposals included under this alternative; therefore, the conclusions presented for Alternative A would apply to this alternative as well.

4.7.1.2.3 Alternative C - Enhance and Restore Habitat/Expand Public Use

The implementation of this alternative would alter the existing use of the salt works by reducing the area currently managed for solar salt production. Under Salt Works Restoration Option 1, the size of the salt works operation within the Refuge would be reduced by approximately 185 acres and by 430 acres under Option 2. The effects of restoring a portion of the salt works on adjacent land uses, both existing and planned under currently adopted local land use plans, would most likely only be discernable to the property owners located adjacent to Pond 10A. Major changes would include the

construction of a low berm around the southern and eastern perimeter of the pond to prevent future inundation of the adjacent properties during extreme high tides and the introduction of tidal exchange within the pond that would result in more frequent and predicable fluctuations in the pond's water level. No land use conflicts are anticipated as a result of these changes. In addition, no public access would be permitted in the vicinity of Pond 10A; therefore, conflicts between existing residential uses and increased human activity are not expected.

To avoid potential conflicts between the restoration proposals for the Otay River floodplain and the existing public facilities in this area that are maintained by the City of San Diego, the development of final restoration plans would be coordinated with the affected departments of the City of San Diego. No conflicts with other adjacent property owners are anticipated.

The eastern most portion of the Refuge is included within the boundaries of the Otay Valley Regional Park planning area. The proposal to restore this area to native upland and coastal wetland habitat would not conflict with the goals of this plan. Further, the proposal to accommodate the Otay Valley Regional Trail along the eastern perimeter of the Refuge would facilitate the Park's goal of developing an east/west regional trail through the entire length of the park.

Opening the northern levee of Pond 11 to public access could result in conflicts with existing uses on the adjacent County Biological Study Area and, to a lesser extent, with the Bayshore Bikeway. These conflicts would relate to increases in the demand for parking, as visitors to the Refuge would park in the County's parking lot, as well as increases in pedestrian traffic on and in the vicinity of the bike path. Additional analysis of these potential conflicts would occur in association with a future step-down plan for this area.

4.7.1.2.4 Alternative D - Maximize Habitat Restoration/Moderately Increase Public Uses (Preferred Alternative)

Maximum restoration of the salt ponds would result in the elimination of the commercial solar salt operation from the Refuge. The effects to surrounding land uses of restoring the salt ponds and the land use effects of restoring the Otay River floodplain would be the same as those described for Alternative C.

The potential conflicts associated with opening the northern levee of Pond 11 would not occur under this alternative; however facilitation of regional trail planning, as described under Alternative C, would also be proposed under this alternative.

The development of environmental education and interpretation programs to be implemented around the perimeter of the Refuge would not be expected to result in any land use conflicts.

4.7.2 Effects to Traffic Circulation and Parking

This section presents the estimated level of traffic that could be generated by the construction/restoration activities associated with the various alternatives, as well as the public uses proposed under each alternative. Also included in this section is an analysis of the potential effects of increased traffic on local and regional traffic circulation and an analysis of the effects that an increased demand for parking could have on the surrounding area.

Adverse effects related to traffic would be considered significant if:

- Project-related traffic would exceed accepted increases in roadway volume to capacity ratios as established by the affected jurisdictions.
- Road capacities were exceeded as a result of proposed actions
- Sight distance provided at ingress/egress points is inadequate.
- A proposed action would substantially increase the demand for on- and/or off-street parking spaces.

4.7.2.1 Sweetwater Marsh Unit

4.7.2.1.1 Alternative A – No Action

Maintaining the current level of management activities and public uses on the Refuge would not result in any new trip generation, nor would the demand for parking increase; therefore, this alternative would not adversely affect traffic circulation or parking availability in the vicinity of the Refuge.

Implementation of restoration projects on the mitigation leasehold overlays would generate construction related traffic. Although no significant adverse affects to traffic circulation are anticipated, the number of trips to be generated and the potential for impacts to local and regional traffic circulation would be evaluated at the time that specific restoration plans are developed for these sites.

4.7.2.1.2 Alternative B – Habitat Enhancement/Interpretation

The management activities proposed under this alternative would not result in any measurable increases in traffic and no new public uses are proposed under this alternative; therefore, no adverse affects to the surrounding local or regional transportation system would result from the implementation of this alternative. Short-term increases in truck traffic could occur if restoration is implemented on the mitigation leasehold overlays. The effects of these increases in traffic would be evaluated once site-specific restoration plans are developed for one or more of the overlays.

Improving tidal circulation in the marsh complex would result in short-term, limited increases in traffic as construction vehicles and crews would travel to and from the Refuge while the various improvements are being completed. The number of trips that would be generated during construction cannot be determined until specific grading plans are developed and the total volume of material to be removed from the site is known. However, because the projects are relatively small, any increase in traffic would be limited in terms of both duration (a few weeks to a few months) and number of trips generated. To minimize the effects of the additional construction traffic on the surrounding circulation system, truck traffic would be restricted to off-peak traffic hours to avoid conflicts with peak congestion periods on local streets and I-5. The number of short-term trips to be generated is not expected to impact the current level of service on the surrounding surface streets or on the freeway system; therefore, no adverse effects to local or regional traffic circulation are anticipated.

4.7.2.1.3 Alternative C –Habitat Restoration/Enhance Public Use (Preferred Alternative)

The restoration activities included under Alternative C would result in short term increases in traffic as construction vehicles and crews travel to and from this Refuge Unit during project implementation. In addition, the excavation required to restore portions of the Refuge to native habitat would likely involve the export of excess material from the site, resulting in short-term increases in truck traffic on adjacent roadways and I-5. The total number of trips to be generated would be evaluated at the time that specific restoration plans are developed for these areas. To avoid adverse direct and cumulative impacts related to traffic congestion during peak traffic periods, truck trips to and from the site would be limited to off-peak hours. Additional measures to reduce adverse traffic impacts, such as a traffic control plan, may be developed once site-specific restoration plans are completed and more precise information regarding anticipated grading volumes become available.

The expansion of the public use programs would result in some permanent increases in traffic generation, as well as some increases in parking demand at the Chula Vista Nature Center parking lot located at the end of E Street. Expanded environmental education programs would result in increases in the number of school buses traveling to and from the Refuge, with little or no private vehicle trips generated. Additional car trips would be generated as a result of improved opportunities for wildlife observation and environmental interpretation; however these new trips would be generated during off-peak traffic periods. The number of trips generated from these activities is expected to be well below 5% of the current traffic volumes on the surrounding local streets and the effect on the total traffic volumes on I-5 as a result of expanding these uses would be minimal. Adequate parking is currently available in the Chula Vista Nature Center parking lot to accommodate increased visitation to the Refuge during normal hours of operation; therefore, expanding the public use programs would have no adverse affect on the availability of parking in the vicinity of the Refuge.

4.7.2.2 South San Diego Bay Unit

4.7.2.2.1 Alternative A – No Action

Maintaining the current level of management activities and public uses on this Refuge would not result in any new trip generation, nor would the demand for parking increase. Therefore, this alternative would not adversely affect traffic circulation or parking availability.

4.7.2.2.2 Alternative B –Enhance Nesting Habitat

To implement the seabird nesting enhancements proposed under this alternative, a maximum of 279,000 cubic yards of fill material and clean sand would be delivered to the Refuge, representing approximately 15,500 truck loads at 18 cubic yards per load. Importing this material to the Refuge would therefore generate approximately 31,000 truck trips to and from the site over the course of the project and approximately 120 to 150 truck trips to and from the site each working day. These numbers represent a worst-case scenario. The actual amount of imported material required would be dependent upon the extent of levee widening that is ultimately proposed.

Under the most optimistic estimates, the proposed levee enhancements would be completed in approximately six months, but could take up to two years depending upon the type and size of construction equipment employed to complete the project, hours of operation, weather, and availability of fill material and sand. Some level of construction

traffic would be generated throughout the course of the project, with the greatest number of trips occurring during project mobilization and demobilization. These temporary increases in traffic would affect Main Street, Bay Boulevard, and possibly I-5 and the I-5/Main Street on and off ramps, depending upon the origin of the material to be imported. With the exception of construction workers traveling to and from the project site each day (no more than 50 trips per AM and PM peak traffic periods), the trips generated from this project would occur during off-peak hours and would be staggered throughout the day. The temporary increase in traffic as a result of this proposal would not be expected to exceed 5% of the current traffic volumes on the surrounding local streets; therefore, no adverse impacts to local or regional traffic circulation are anticipated.

No additional uses are proposed under this alternative; therefore, no new public use-related trips would be generated under this alternative and there would be no increase in parking demand under this alterative.

4.7.2.2.3 Alternative C – Enhance and Restore Habitat/Expand Public Uses

A number of restoration scenarios could occur under this alternative, as described in Section 2.3.2.4. In addition, the nesting enhancements proposed in Alternative B would be implemented under any of these scenarios. Table 4-3 presents the estimated volumes of import and export that would be needed for each restoration scenario and the total number of truck trips required to move this material to or from the site over the course of the project.

Table 4-3
Import/Export Estimates and Associated Truck Trips
for Various Restoration Scenarios Under Alternative C

Restoration Scenario	Estimated Import (cubic yards)[1]	Estimated Export (cubic yards)	Estimated Truck Trips[2] (over the life of the project)
Otay Option 1 only	116,000	0	12,890
Otay Option 1 and Salt Works Option 1	116,000	0	12,890
Otay Option 1 and Salt Works Option 2	116,000	0	12,890
Otay Option 2 only	116,000	352,000	52,000
Otay Option 2 and Salt Works Option 1	116,000	186,800	33,640
Otay Option 2 and Salt Works Option 2	116,000	0	12,890
Salt Works Option 1 only	438,600	0	48,740
Salt Works Option 2 only	741,500	0	82,390

[1]The import volumes all include 116,000 cubic yards of clean light-color sand for nesting enhancements.
[2]This figure represents trips to and from the site.

Based on the amount of material that can be moved into or out of a project site in one day, it is estimated that the maximum number of truck trips that would be generated from the project would range from 120 to 150 truck trips per working day throughout the course of the project. An additional 50 trips per day would be attributed to construction workers traveling to and from the project site. The majority of the trips generated under this alternative would occur during off-peak hours and would be staggered throughout the day. The temporary increase in traffic as a result of this proposal would not be expected to exceed 5% of the current traffic volumes on the surrounding local streets; therefore, no adverse impacts to local or regional traffic circulation are anticipated.

The total number of trips generated by the project could be reduced by using the existing rail line located adjacent to the project site for transporting material into or out of the site. The feasibility of such a measure would be dependent upon the source of the imported material and/or the ultimate destination of any exported material. The most likely option for rail use would be associated with the import of clean sand to the site for use on the proposed nesting areas.

Under Alternative C, public uses on the Refuge would be expanded to include regular guided nature tours of the salt works, the development of an environmental education program near Bayside Elementary School, and the opening of the northern levee of Pond 11 to public access for fishing and wildlife observation. The proposal to expand the current uses on the Refuge would generate additional vehicular trips to and from the Refuge; however, these trips would generally occur during non-peak hours and would not exceed 5% of the existing traffic volumes on the surrounding streets; therefore, the additional trips would not adversely affect local or regional traffic circulation.

With respect to parking demand, the guided nature tours would generate an additional parking demand of six to 10 parking spaces per tour. Adequate space is currently available near the salt works entrance to accommodate this parking on the weekends. If tours were to be conducted during the week, alternate parking arrangement may be required, such as meeting at the Chula Vista Nature Center parking lot and carpooling to the salt works. Such a proposal would not adversely impact available parking in the vicinity of the salt works or at the Nature Center parking lot. The environmental education program proposed in the vicinity of the Bayside Elementary School would generate relatively few automobile trips, with much of the participation in the program generated from existing students at Bayside Elementary School. Students from other schools would most likely be transported to the site via bus or van; therefore, the limited demand for parking that would be generated by this use could be accommodated on the existing school site or via on-street parking available immediately adjacent to the school.

Opening the northern levee of Pond 11 to public access would create a new demand for parking at the entrance to the levee. The County of San Diego recently completed renovations to the parking lot located immediately to the north of the Refuge along SR-75. This lot, which includes 22 parking spaces, currently provides a staging area for users of the Bayshore Bikeway, as well as visitors to the Biological Study Area. Opening the levee to public fishing and wildlife observation would increase the use of this lot, possibly resulting in demand that exceeds the capacity of the current lot. If the lot becomes full, users might inappropriately park along the edge of SR-75, resulting in a potential traffic hazard. Prior to developing a public use plan for this levee, a detailed parking analysis would be required to determine the potential effects on the existing parking lot of opening the levee to public access.

4.7.2.2.4 Alternative D – Maximize Habitat Restoration/Moderately Increase Public Use (Preferred Alternative)

As was addressed in Alternative C, there are also a number of restoration scenarios that could occur under Alternative D. These scenarios and the anticipated number of truck trips to and from the site are presented in Table 4-4.

Table 4-4
Import/Export Estimates and Associated Truck Trips
for Various Restoration Scenarios Under Alternative D

Restoration Scenario	Estimated Import[1] (cubic yards)	Estimated Export (cubic yards)	Estimated Truck Trips[2]
Restored Salt Ponds (modified pond elevations)	135,000	0	15,000
Restored Salt Ponds (modified pond elevations) + Otay Restoration Option 1	135,000	0	15,000
Restored Salt Ponds (modified pond elevations) + Otay Restoration Option 2	127,400	501,800	69,900
Restored Salt Ponds (breach only)	300,700	0	33,400
Restored Salt Ponds (breach only) + Otay Restoration Option 1	127,400	0	14,150
Restored Salt Ponds (breach only) + Otay Restoration Option 2	127,400	336,100	51,500

[1]The import volumes all include 116,000 cubic yards of clean light-color sand for nesting enhancements.
[2]This figure represents trips to and from the site.

Based on the amount of material that can be moved into or out of a project site in one day, it is estimated no more than 120 to 150 truck trips per working day would be generated throughout the course of the project. An additional 50 trips per day would be attributed to construction workers traveling to and from the project site. The majority of the trips generated under this alternative would occur during off-peak hours and would be staggered throughout the day. The temporary increase in traffic as a result of this proposal would not be expected to exceed 5% of the current traffic volumes on the surrounding local streets; therefore, no adverse effects to local or regional traffic circulation are anticipated. As discussed under Alternative C, some reduction in the total number of trips generated by the project could be achieved if some material could be transported to or from the site via the existing rail line in the vicinity of the project.

Under Alternative D, the current public uses permitted on the Refuge would be expanded to include some of the uses proposed under Alternative C, such as regular guided nature tours of the salt works and the development of an environmental education program near

Bayside Elementary School. This alternative does not include the proposal to open the northern levee of Pond 11 to public access, but does include the development of an environmental interpretation plan for the areas around the southwest perimeter of the Refuge, as well as the development of wildlife observation points in the same general area.

These proposals would generate additional non-peak hour vehicular trips to and from the Refuge; however, the total number of trips generated would not be expected to exceed 5% of the existing traffic volumes on the surrounding streets. No impacts to the County's new parking facility near Pond 11 would result as levee access is not proposed under this alternative. Many of the interpretive elements and observation areas proposed under this alternative would be accessible to bicyclists traveling along the Bayshore Bikeway, which could reduce some of the vehicular trips that would otherwise be generated.

Because the salt works operation would cease under this alternative, it is possible that the Airport Authority could lease the land currently used for salt processing to another entity. Coordination with the Airport Authority would therefore be necessary to assure the availability of some parking in the vicinity of the restored salt ponds to accommodate the uses proposed within this portion of the Refuge.

The proposal to construct wildlife observation areas along the perimeter of the Refuge would result in limited increases in parking demand at the various locations. However, the additional need for parking that would be generated by this use could be accommodated by the existing parking areas already provided in the vicinity of the proposed observation points.

4.7.3 Effects to Public Utilities/Easements

This section analyzes the potential effects of the various management alternatives on existing public utilities and easements in the immediate vicinity of the Refuge.

Adverse effects to public utilities and easements would be considered significant if:

- Direct or indirect damage to utilities, utility service, or other public facilities would occur as a result of a proposed action.
- Utilities or other public facilities would be relocated, either permanently or temporarily to accommodate a proposed action.
- Disruption of access to a public utility or other facility or temporary obstruction of an easement would occur during implementation of a proposed action.

4.7.3.1 Sweetwater Marsh Unit

4.7.3.1.1 Alternative A – No Action

There are no public utilities located on this Refuge Unit that would be adversely affected by the continuation of current management activities on the Refuge, nor would this alternative adversely affect the existing access easement provided to the Nature Center.

4.7.3.1.2 Alternative B –Habitat Enhancement/Interpretation

The proposal to improve tidal circulation in the marsh complex by installing an additional culvert under the existing access road to the Refuge office and Nature Center would result in the short-term disruption of vehicular access to and from the Refuge. The timing of this

improvement would be coordinated with the Nature Center to minimize disruption to the operation of the Nature Center.

4.7.3.1.3 Alternative C –Habitat Restoration/Enhance Public Use (Preferred Alternative)

The tidal circulation improvements described in Alternative B are also included in this alternative; therefore, the evaluation of effects from this proposal on the Nature Center's access easement would be the same as that described above. No other impacts to public facilities or easements are anticipated.

4.7.3.2 South San Diego Bay Unit

4.7.3.2.1 Alternative A – No Action

The proposal to continue current management activities would have no positive or adverse effects on existing public utilities or easements in the vicinity of this Refuge Unit.

4.7.3.2.2 Alternative B – Enhance Nesting Habitat

The proposal to enhance nesting opportunities on the salt pond levees would not affect existing public utilities or easements in the project vicinity.

4.7.3.2.3 Alternative C - Enhance and Restore Habitat/Expand Public Uses

The majority of the utilities and other public facilities that could be affected by the restoration proposals included in this alternative are located within or to the east of the unimproved section of Saturn Boulevard that extends north/south through the Refuge. Many of these facilities are located outside the current Refuge boundary within property owned and maintained by the City of San Diego, while others are included in existing easements that traverse this portion of the Refuge. A bicycle path also extends through this area with some portions included on City owned land and others within an existing public easement. Restoration planning for the Otay River floodplain would require the incorporation of measures to avoid direct and indirect adverse effects to these facilities and public easements. Such adverse effects could include direct impacts during construction and/or indirect impacts following construction as a result of the potential for increased scour within the floodplain, increased riverbank erosion, and/or additional headcutting in the main river channel during heavy storm events. These types of impacts could be avoided by realigning the affected facilities or protecting the facilities in place using bank stabilization techniques, such as riprap, concrete slope protection, geotextile soil reinforcement, biotechnical measures, and/or grade control structures (e.g. precast concrete mats, armorflex, reinforced concrete drop structures, grouted stone drop structures, cutoff walls). The specific measures to be incorporated into the design would be determined during detailed restoration planning in consultation with the appropriate departments of the City of San Diego and/or other affected agencies. These plans would also address the need for continued maintenance access to the various utilities within the restoration area.

Another potential impact to buried utilities would involve the placement of additional fill above these facilities. The placement of fill over settlement sensitive utility lines could result in damage to the lines, as well as make routine maintenance and repair of these utilities more difficult. To avoid significant adverse effects to the existing utilities within this area, consultation with the affected agencies would be conducted prior to developing final restoration plans and appropriate measures would be incorporated into the restoration plans to protect existing utilities. Such measures could include minimizing the

amount of fill to be placed over these utilities, avoiding abrupt changes in fill thickness, and/or upgrading the utilities to handle the additional soil loads.

Grading activities could also disrupt bicycle access through the area; therefore, construction plans would include measures to ensure continued bicycle access from Main Street to Palm Avenue during construction. This may result in the temporary rerouting of the path to separate bicycle users from adjacent construction activity. The proposed changes to the Otay River channel could also require the reconstruction of the existing bridge that crosses the Otay River along unimproved Saturn Boulevard. If chances to the bridge are deemed necessary, the redesign would be coordinated with the City of San Diego, which will be required to maintain the existing bridge and future bicycle path.

Depending upon the final restoration design for the Otay River floodplain, restoration could result in direct and indirect impacts to the Bayshore Bikeway. Direct impacts could occur during excavation if temporary access routes are established to facilitate the off-street transport of fill material from the Otay River floodplain to the salt works. Adverse effects could include physical impacts to the bike path surface, assuming the bike path is constructed prior to restoration, or disruption of bicycle movement along the Bayshore Bikeway during construction. Indirect impacts to the bikeway could occur following construction as a result of increased flood elevations in the vicinity of the western most railroad bridge and/or increased scour in the vicinity of the bridge. To minimize direct impacts, construction plans and phasing would be coordinated with the City and County of San Diego and SANDAG. Additional hydrological studies would be conducted prior to the approval of final restoration plans to determine if and to what extent damage to the railroad bridge could occur as a result of the final restoration design. If these studies determine that there is a potential for impacts to the bridge, appropriate mitigation measures, including possible reinforcement of the bridge structure, would be incorporated into the restoration project.

Finally, this proposal could result in the desire to relocate existing overhead power lines to reduce the potential for avian predation within the restored wetlands. All such proposals would be coordinated with San Diego Gas and Electric prior to completing the final restoration plans.

4.7.3.2.4 Alternative D - Maximize Habitat Restoration/Moderately Increase Public Use (Preferred Alternative)

No impacts to public utilities are anticipated as a result of restoring the salt ponds to tidal action. The effects to public utilities and easements within the Otay River floodplain would be the same as those described under Alternative C.

4.7.4 Effects to Public Access, Education, and Recreational Opportunities

Adverse effects to public access, education, and recreational opportunities would be considered significant if:

- Substantial displacement of public recreation and educational activities or opportunities would occur as a result of a proposed action.
- Existing public access to the bay would be substantially reduced as a result of a proposed action.

4.7.4.1 Sweetwater Marsh Unit

4.7.4.1.1 Alternative A – No Action

No changes to public access or the education and recreational opportunities existing in the vicinity of the Refuge would occur as a result of this alternative. Public access would continue to be restricted to the Gunpowder Point and access onto the Refuge would continue to be permitted only via the existing shuttle that transports visitors at no charge from an offsite parking lot to the Chula Vista Nature Center. The environmental education programs currently being implemented by the Nature Center would also continue under this alternative.

No public access routes currently exist through the Refuge that would be disrupted as a result of this or any of the other alternatives proposed for the Sweetwater Marsh Unit.

4.7.4.1.2 Alternative B – Habitat Enhancement/Interpretation

The effects to public access, education, and recreational opportunities would be the same as described for Alternative A.

4.7.4.1.3 Alternative C –Habitat Restoration/Enhance Public Uses (Preferred Alternative)

Under this alternative, the environmental educational programs implemented on the Refuge would be expanded to reach additional school children. Public access within the Refuge would remain unchanged; however, the trail system on Gunpowder Point would be redesigned to better accommodate the educational, interpretive, and wildlife observation activities supported by the Refuge.

4.7.4.2 South San Diego Bay Unit

4.7.4.2.1 Alternative A – No Action

Under this alternative, public access to the Refuge would continue to be limited to occasional guided nature tours around the salt ponds. Visual access into the Refuge would also continue to be provided along the Bayshore Bikeway. At present, the primary educational activity associated with the salt works relates to the study of *Halobacterium* and other Archaeans (refer to Section 3.4.2.2.) that are supported in the hypersaline waters of the crystallizer ponds. Recreational opportunities occurring in the open waters of the Refuge related to boating and fishing would continue under this alternative.

No public access routes currently exist through the Refuge that would be disrupted as a result of this alternative.

4.7.4.2.2 Alternative B - Enhance Nesting Habitat

The effects to public access, education, and recreational opportunities would be the same as described for Alternative A.

4.7.4.2.3 Alternative C - Enhance and Restore Habitat/Expand Public Uses

Public access would be expanded on the Refuge to include the opening of the northern levee of Pond 11. In addition, a proposed alignment for the western end of the Otay Valley Regional Trail is addressed in the CCP to facilitate the implementation of the Otay Valley Regional Park plan. Recreational opportunities occurring in the open waters of the Refuge related to boating and fishing would continue. Restoration of the Otay River floodplain could result in temporary disruptions to public access along the bike path that follows the unimproved portion of Saturn Boulevard, as well as the Bayshore Bikeway (refer to

Section 4.7.3.2). Temporary rerouting of these trails may be required to minimize impacts to public access.

The Habitat Heroes environmental education program would continue under this alternative with the proposal to reach additional students through partnerships with other agencies and organizations. The study of *Halobacterium* and other Archaeans would also likely continue because commercial salt production is proposed as a component of this alternative.

4.7.4.2.4 Alternative D - Maximize Habitat Restoration/Moderately Increase Public Use (Preferred Alternative)

Under Alternative D, expansion of public access on the Refuge would be limited to the possible construction of Otay Valley Regional Trail through the eastern end of the Refuge. Access would not be permitted on the northern levee of Pond 11. Visual access onto the Refuge would be expanded as the result of the construction of various observation areas along the perimeter of the Refuge.

Potential short term impacts to public access along the Bayshore Bikeway and on the bike path in Saturn Boulevard related to the restoration of the Otay River floodplain would also occur under this alternative, but could be minimized through appropriate rerouting of public access during construction (refer to Section 4.7.3.2).

The Habitat Heroes environmental education program would continue under this alternative; however, opportunities for studying *Halobacterium* and other Archaeans would be eliminated as a result of the closure of the salt works.

4.7.5 Effects Related to Vectors and Odors

This section discusses the potential prevalence of vector populations under each of the alternatives, as well as the potential generation of unpleasant odors. Effects related to vectors would be considered significant if:

- Habitat changes would necessitate substantially increasing levels of mosquito abatement programs to maintain mosquito populations at pre-project levels (adverse).
- Habitat changes would result in a substantial decline of available mosquito breeding habitat (beneficial).

The generation of offensive odors could represent a nuisance to adjacent residents located in adjacent recreational areas, work sites, and commercial areas. Offensive odors can represent a significant adverse effect if the strength and/or the persistence of the odors are substantial and if the odors would affect a substantial number of people.

4.7.5.1 Sweetwater Marsh Unit

Vectors

No changes related to the production or control of vectors are anticipated under any of the alternatives being considered for the Sweetwater Marsh Unit. The enhancement and restoration proposals addressed in Alternatives B and C address only salt marsh and upland habitats; no significant changes to the freshwater and brackish water marshes located along the extreme eastern edge of the Refuge are proposed. Therefore, no

significant shift in the Refuge's current mosquito composition would be expected under either of these alternatives.

Odors

The excavation proposals included in Alternatives B and C could expose decomposed organic material resulting in the generation of some odors during project implementation. No odors would be generated under Alternative A. The enhancement and restoration sites proposed under Alternatives B and C are generally located in remote areas of the Refuge separated from human receptors by substantial areas of open space. No adverse effects related to unpleasant odors are therefore anticipated under any of the proposed alternatives.

4.7.5.2 South San Diego Bay Unit

Vectors

No proposals are included under Alternatives A or B that would change the existing conditions within the Otay River floodplain; therefore, the Refuge's current mosquito composition would remain unaltered.

Under Alternative C, the freshwater habitat that occurs within the Otay River floodplain would be expanded and salt marsh habitat would be restored within much of the remaining floodplain. These changes have the potential to alter the Refuge's current mosquito species composition. The final restoration plans would take into consideration the need to avoid creating habitat that could benefit mosquito breeding in proposed freshwater and brackish wetland habitats. The plans would also include designs that provide adequate access paths for aquatic predators that feed on mosquito larvae. One such design would involve maintaining deep water channels (greater than 4 feet) that break up areas of dense emergent vegetation.

The restoration proposal within Alternatives C and D to create 60 to 90 acres of salt marsh vegetation within the Otay River floodplain would provide potential habitat for *Ochlerotatus taeniorhynchus* and *Ochlerotatus squamiger*, two salt marsh mosquitoes that reproduce in the intertidal marshes of the California coast. These mosquitoes are not currently suspected of carrying human diseases, but can be a nuisance during certain times of the year. Salt marsh mosquito production would be monitored and appropriate control would be considered if production becomes a significant nuisance to adjacent residents.

The restoration proposals for the salt ponds under Alternatives C and D include predominantly low and mid-marsh habitat that is inundated daily by the tides; therefore, little habitat appropriate for salt marsh mosquito breeding would be created. There is a potential for the creation of conditions conducive to salt marsh mosquito production along the edge of Pond 10A, but this potential would be minimized by appropriate contouring of the pond edges to reduce pooling of water after higher high tide events.

No effects on mosquito species composition would result from developing the managed water systems proposed under Alternative D, because the ponds would be maintained at salinities that would not support mosquito production.

Odors

The existing operation at the salt works results in the generation of odors within some ponds due to the decomposition of organic materials. These odors are particularly

prevalent in Pond 20 and occasionally in Pond 10A. This condition would continue under Alternatives A or B.

Grading activities related to restoration of one or more of the salt ponds, as proposed in Alternatives C and D, could expose decomposed organic material resulting in the generation of some odors during grading. If noticeable, those receptors most likely affected would be downwind of the excavation and/or located in the vicinity of Pond 10A. The principal wind direction in the vicinity of the main salt works complex is to the east; therefore, any odors generated by excavation within the salt ponds in this area would most likely be directed to the east, where industrial activity is the predominant land use. Although some residences are located between I-5 and Bay Boulevard, they occur a considerable distance from the restoration site and would likely not be affected by nuisance odors. There is the potential for residents in proximity to Pond 10A to experience some adverse odors during construction; however, these odors, if generated, would occur only for a short period of time during excavation within Pond 10A. Once restoration is completed, the odors generated from this pond under current conditions (during periods when the water levels in the pond are very low) would be expected to diminish as a result of the introduction of tidal circulation.

The implementation of Alternative C would require some reconfiguration of the remaining salt ponds to accommodate solar salt production. Just as some ponds in the current system produce unpleasant odors at certain times of the year, other ponds could generate similar odors once the system is reconfigured. It is not possible at this time to predict where in the system this could occur. Based on the current land uses in the vicinity of the salt works, the potential generation of odors from the reconfigured salt operation is not expected to adversely affect any human receptors. This situation would not occur under Alternative D.

4.7.6 Effects to Economics/Employment

This section discusses the direct and indirect economic effects on the regional economy of implementing the various alternatives presented for each Refuge. Economic or social changes resulting from an action are considered to produce significant effects if they result in a substantial adverse physical change in the environment (e.g., urban blight).

4.7.6.1 Sweetwater Marsh Unit

Historically, the annual base budget for the Sweetwater Marsh Unit comprises most of the Refuge's annual funding. Other revenue sources include supplemental annual funding for control of invasive species and brush management and special projects funded through Federal challenge cost-share grants. In typical years, approximately 85% of the Refuge's operating budget is spent on salaries and employee benefits. The remainder is usually spent on routine operating expenses, annual maintenance, equipment, supplies, contractors, vendors, volunteer projects, travel, and training. The Refuge does not obtain any income from visitors, as access to those portions of the Refuge that are open to the public does not require an entrance fee.

Because most Refuge funding comes from the Federal government and other sources that are external to the local economy, the Refuge's payroll and other expenditures comprise net revenue for the local economy. Thus, every federally supported job at the Refuge results in local expenditures and indirectly supports additional employment in the region.

Although the land included within the Refuge is federally owned and therefore provides no property taxes, several factors offset this loss of property tax revenue to local government. First,

Refuge lands and waters demand little in the way of expensive infrastructure or services. Second, when the Service acquires private land in fee, Congress allocates payments to counties under the Refuge Revenue Sharing Act to partially compensate for the loss of property taxes. In addition, the designation of this property as a Refuge and the resources protected within the Refuge contribute to the local economy by drawing visitors from outside the county to the area for bird watching, environmental interpretation, and other ecotourism related activities. While visiting areas such as this Refuge, visitors contribute additional sales taxes to local governments, as well as transit occupancy taxes (TOT) that are used by local governments to fund a variety of local services. Most visitors to this Refuge Unit also provide funds to the Chula Vista Nature Center, operated by the City of Chula Vista, through a Nature Center entrance fee and any purchases made at the Center's gift shop.

Alternative A – No Action

Under the No Action Alternative, the Refuge's annual base budget and staffing are expected to remain comparable to historical funding and staffing levels. In 2003, the Refuge Complex's base budget was approximately $1.5 million, sufficient to support the equivalent of approximately 15 full time equivalent (FTE) employees. Under this alternative, staffing would be maintained at current levels. These existing jobs would represent a small, yet positive, contribution to the regional economy.

Alternative B –Habitat Enhancement/Interpretation

This alternative includes several one-time construction projects associated with improving tidal circulation within the marsh complex. The implementation of these projects, which are estimated to cost approximately $500,000, would likely involve private contractors, thereby providing additional minor benefits to the regional economy in terms of additional short-term jobs in fields such as construction, engineering, and biological consulting.

Alternative C –Habitat Restoration/Enhance Public Uses (Preferred Alternative)

Under this alternative, staffing within the Refuge Complex would be increased to approximately 18 FTEs. Employment would increase in the categories of biology, public use, and resource management. In addition, approximately $3 million in habitat restoration projects are proposed under this alternative. This money would be used to pay for contractors, equipment rentals, and materials needed to implement the proposed projects. Although the additional influx of money into the local economy as a result of this work would be temporary, it would still represent a positive effect on the regional economy.

4.7.6.2 South San Diego Bay Unit

Similar to the Sweetwater Marsh Unit, most of the annual funding for the South San Diego Bay Unit is provided by the Refuge's annual budget. Other revenue sources include supplemental annual funding for control of invasive species and brush management and special projects funded through Federal challenge cost-share grants. No income is provided to the Refuge in the form of entrance fees.

As described above, the Refuge's payroll and other expenditures comprise net revenue for the local economy and indirectly support additional employment in the region. In addition, payments are made to the County of San Diego under the Refuge Revenue Sharing Act to partially compensate for the loss of property taxes and visitors to the Refuge contribute additional sales taxes to local governments, as well as TOT.

Alternative A – No Action

Under the No Action Alternative, the Refuge's annual base budget and staffing are expected to remain comparable to historical funding and staffing levels. As a result, the Refuge's annual base budget would continue to contribute minor positive effects on the regional economy.

Also under this alternative, the existing commercial solar salt operation would remain in production. This operation currently employs approximately 22 people with overall estimated annual earnings in 1994 of $670,000 and estimate total sales of $4.9 million (*Niehaus 1994 in USFWS 1999*). A percentage of the revenues from this operation are currently paid to the Airport Authority by the salt works operator in accordance with the current lease between the Airport Authority and South Bay Salt Works. Under the Cooperative Agreement no revenues from this operation would come to the Service until after 2009.

No significant new benefits or adverse effects to the regional economy would occur under this alternative.

Alternative B – Enhance Nesting Habitat

Under this alternative, the annual budget and staffing for the Refuge would remain generally unchanged from current conditions. This alternative does however include a variety of enhancement projects that, when implemented, would involve a total expenditure of approximately $2.5 million. Although this is a relatively minor amount of funding when viewed in terms of the regional economy, it would result in direct expenditures that would be used to purchase materials and retain contractors. This alternative would therefore provide minor benefits to the regional economy.

Alternative C –Enhance and Restore Habitat/Expand Public Uses

Under this alternative, the number of FTEs within the Refuge Complex would increase to 20 FTEs, with increases in staffing related primarily to volunteer coordination, maintenance, and resource management. Up to an additional $9 million in restoration funds would be expended over a period of a number of years. This expenditure would represent a minor benefit to the regional economy in terms of additional short-term jobs and local purchases.

The expansion of public uses on the Refuge would result in several one time expenditures to design and construct necessary facilities. Expanding these uses is expected to generate additional visitors to the region, due to the exceptional wildlife observation opportunities that would be available under this alternative. The economic effects of establishing the South San Diego Bay Unit were evaluated as part of the Environmental Assessment for Refuge establishment (*USFWS 1999*). This analysis, which is incorporated into this document by reference, projected the net annual increase in visitors to the area that could be attributed to the South San Diego Bay Unit, to be up to 80,000 (*Niehaus 1994*). This estimate did not specifically take into consideration the provisions within this alternative for additional habitat areas and new opportunities for wildlife observation that are included within this alternative. The net annual increase attributed to this Refuge could therefore be higher. The increase of up to 80,000 additional visitors to the region translates to an estimated increase in expenditures related to retail trade, lodging, and food service of as much as $7.5 million (in constant 1992 dollars). Indirect employment of up to 172 jobs with associated earnings of $4.5 million could also be expected (*Niehaus 1994*).

To accommodate proposed restoration, the footprint of the current solar salt operation would be reduced, thereby reducing the annual revenues for the operation. This would likely lead to the elimination of several positions at the facility. Although significant to those directly affected by job loss and the loss in revenues to the company from downsizing, in terms of the region's economy, the adverse effects would be minimal. The additional benefits derived from increasing Refuge staffing would offset some of the losses to the local economy from downsizing the salt works operation.

Alternative D – Maximize Habitat Restoration/Moderately Increase Public Use (Preferred Alternative)

Under this alternative, staffing at the Refuge Complex could increase to a total of 24 FTEs and one temporary full time equivalent, with increases in staffing related primarily to biology, water management, resource management and monitoring, and maintenance. This alternative also proposes the expenditure of an estimated $11 million to restore coastal wetlands and establish water and brine management areas within the Refuge. The funds, which would be expended over a number of several years, would represent a minor benefit to the regional economy in terms of additional short-term jobs and local purchases. Wildlife observation opportunities, although different from those provided in Alternative C, would also be expanded.

The habitat restoration proposals included under this alternative would require the closure of the existing solar salt operation and the loss of approximately 22 jobs. The reduction in annual earnings as a result of eliminating the salt works was estimated in the environmental assessment prepared for establishment of the South San Diego Bay Unit (*USFWS 1999*) at $670,000 and the annual loss in sales was estimated to be in the range of $5 million dollars (in constant 1992 dollars). Losses to the regional economy would be higher in 2007 dollars, which is when the current lease and Refuge Special Use Permit expire. There are no other viable locations in the region to establish a new solar salt operation; therefore, relocation of this operation to another site in an effort to maintain the current economic benefits of a facility of this size would not be possible.

Based on the estimates provided in the environmental assessment (*USFWS 1999*), it would appear that the economic contributions to the region related to increases in visitors, although not considered regionally significant, would offset the economic losses to the region associated with the elimination of the salt works. The implementation of this alternative would therefore have no adverse effect on the regional economy.

4.7.7 Effects to Environmental Justice

This section evaluates the potential for adverse human health or environmental effects to minority populations or low-income populations living in the vicinity of the south bay Refuges as a result of implementing the various actions proposed in each alternative. Impacts related to environmental justice would be considered significant if:

A proposed action would result in disproportionate adverse human health impacts or environmental effects to low-income or minority populations.

4.7.7.1 Sweetwater Marsh Unit

4.7.7.1.1 Alternative A – No Action

Continuing to manage the Sweetwater Marsh Unit as it has historically been managed would not result in any adverse human health or environmental effects to minority or low-income populations. Environmental education and interpretation programs currently supported by the Refuge, such as Sweetwater Safari, would continue to provide benefits to school children, including minority and low-income populations. Transportation onto the Refuge, which is provided to the public free of charge by the City of Chula Vista, is available from a location that is easily accessible via public transportation, including city buses and the San Diego Trolley. Transportation is also available at no cost for those schools that do not have funding to transport students from the school to the Nature Center and Refuge for environmental education classes. This transportation is funded through a private grant in support of the Sweetwater Safari program.

4.7.7.1.2 Alternative B –Habitat Enhancement/Interpretation

Those aspects of this alternative that involve Refuge participation in watershed planning and continued oversight of contaminants evaluation and remediation would provide a benefit to the surrounding communities. The improvements in tidal circulation within the marsh could also provide some benefits to the bay with respect to improved water quality. The other benefits related to environmental justice that are described in Alternative A would also be provided under this alternative.

4.7.7.1.3 Alternative C –Habitat Restoration/Enhance Public Uses (Preferred Alternative)

Under this alternative, the existing public uses would be expanded to include additional opportunities for environmental interpretation. This interpretation would address an array of topics including Native American use of the lands within the Refuge. The outreach program that is included under this alternative would provide opportunities for inviting a larger segment of the community to participate in Refuge activities.

4.7.7.2 South San Diego Bay Unit

4.7.7.2.1 Alternative A – No Action

Continuing to manage the South San Diego Bay Unit as it has been managed since its establishment in 1999 would not result in any adverse human health or environmental effects to minority or low-income populations.

4.7.7.2.2 Alternative B - Enhance Nesting Habitat

The proposals for enhancement of endangered species nesting would not result in any adverse human health or environmental effects to minority or low-income populations.

4.7.7.2.3 Alternative C - Enhance and Restore Habitat/Expand Public Uses

This alternative includes various proposals that would benefit the environment in the vicinity of the Refuge including restoration of the Otay River floodplain and participation in watershed planning efforts for the Otay River watershed. The implementation of these proposals would improve the quality of the water entering the bay, reduce habitat quality for mosquito production, and provide limited benefits with respect to upstream flooding in the vicinity of Nestor Creek. The public use proposals included under this alternative would also provide opportunities for surrounding residents to participate in environmental education and other programs to be implemented on the Refuge. No adverse effects of the proposed restoration or public use proposals related to environmental justice are anticipated.

4.7.7.2.4 Alternative D - Maximize Habitat Restoration/Moderately Increase Public Use (Preferred Alternative)

The benefits related to human health and the environment described under Alternative C would also occur as a result of implementing this alternative. In addition, opportunities for wildlife observation and environmental interpretation would be expanded, providing residents of the surrounding communities with recreational and educational activities that can be easily accessed via public transportation, by bicycle, and on foot.

4.8 Summary of Effects

4.8.1 Sweetwater Marsh Unit

Provided in Table 4-5 is a summary of the potential effects associated with each of alternatives evaluated for this Refuge Unit.

4.8.2 South San Diego Bay Unit

The potential effects for each of the alternatives evaluated for the South San Diego Bay Unit are presented in Table 4-6.

4.9 Cumulative Effects

Cumulative effects can result from the incremental effects of a project when added to other past, present, and reasonably foreseeable future projects in the area. Cumulative impacts can result from individually minor but cumulatively significant actions over a period of time. This analysis is intended to consider the interaction of activities at the Sweetwater Marsh Unit and the South San Diego Bay Unit with other actions occurring over a larger spatial and temporal frame of reference. The interrelated effects of separate actions under the alternatives are also considered.

4.9.1 Projects Considered in the Cumulative Effects Analysis

Various projects are currently being planned for implementation in the vicinity of the Refuge. These proposals, which are outlined below, have been considered in this evaluation of cumulative impacts. Also considered in this analysis are other habitat restoration projects currently being considered or implemented along the southern California coast.

Chula Vista Bayfront Master Plan

The Port and the City of Chula Vista are currently developing plans for the redevelopment of approximately 550 acres of land and water located along the eastern edge of San Diego Bay between the Sweetwater Marsh Unit and the South San Diego Bay Unit. The 550 acres are being considered for the development of a broad range of urban uses, including high- and mid-rise residential development, commercial and office space, hotels, restaurants, major entertainment facilities, public open space, improvements to the existing harbor, and relocation of the existing boat channel in the South Bay.

Issues associated with future redevelopment of this area could include the loss and/or degradation of upland, coastal wetland, and eelgrass habitats, disturbance to wildlife in and adjacent to the bay, changes to water and air quality, effects to cultural resources, increased traffic volumes, changes in the visual quality of the area, and potential effects to human health and minority or low-income populations.

Table 4-5 Summary of Potential Effects of Implementing Alternatives A, B, or C for the Sweetwater Marsh Unit			
Resource	Alternative A	Alternative B	Alternative C
Physical Environment			
Topography/Visual Quality	No change in existing conditions	No change in existing conditions	No adverse effects, but moderate benefits to visual quality would result from replacing weedy, nonnative vegetation on Gun-powder Point with native habitat.
Agricultural Resources	No change in existing conditions	No change in existing conditions	No adverse effects.
Hydrology	No change in existing conditions	Various impediments to tidal and freshwater circulation in the marsh would be removed representing a moderate benefit to overall habitat quality in the marsh.	Similar benefits to those described for Alternative B, with some additional benefits related to increases in the tidal prism as a result of intertidal restoration.
Water Quality	No change in existing conditions	Implementation of Best Management Practices would reduce the potential for adverse effects from grading to less than significant. Additional analysis of contaminants issues in Paradise Marsh would be required prior to implementing enhancements in this area.	Same as Alternative B and additional analysis of contaminants issues in the F& G Street Marsh would be required prior to implementing restoration in this area.
Habitat			
Coastal Salt Marsh	No change in existing conditions	Minor temporary adverse effects could result during implementation of tidal circulation improvements, but these would be offset by the moderate benefits to habitat quality resulting from improvements in tidal circulation.	Minor temporary adverse effects could result from construction activities during restoration and enhancement, but these would be more than offset by the significant benefits resulting from improved circulation and the restoration of 25 acres of intertidal wetlands.

Table 4-5 (continued) Summary of Potential Effects of Implementing Alternatives A, B, or C for the Sweetwater Marsh Unit			
Resource	Alternative A	Alternative B	Alternative C
Habitat(continued)			
Native Uplands	No change in existing conditions	Slight benefits to uplands habitat would result from increased control of nonnative invasive plant species.	Restoring 20 acres of native upland habitat on Gunpowder Point would represent a significant benefit.
Least Tern and Snowy Plover Nesting Habitat	No change in existing conditions	Moderate benefits would result from expanded management at the D Street Fill.	Retaining ten additional acres of nesting habitat on D Street Fill would provide moderate benefits.
Wildlife and Fisheries			
All Birds	No change in existing conditions	Expanding management of salt marsh habitat, improving tidal and freshwater circulation; and enhancing seabird nesting habitat on D Street Fill would provide moderate benefits to birds.	Combining the benefits described for Alternative B with the restoration of 25 acres of salt marsh habitat and 20 acres of upland habitat and the designation of 33 acres on D Street Fill for seabird nesting would result in be significant benefits to birds.
Waterfowl	No change in existing conditions	Action described above would provide slight benefits for waterfowl.	Same as Alternative B
Seabirds	No change in existing conditions	Action described above would provide moderate benefits for seabirds.	Actions described above would provide slightly greater benefits for seabirds than those provided by Alternative B.
Shorebirds and Other Waterbirds	No change in existing conditions	Action described above would provide moderate benefits for shorebirds and other waterbirds.	Actions described above would provide slightly greater benefits for shorebirds and other waterbirds than those provided by Alternative B.

Table 4-5 (continued) Summary of Potential Effects of Implementing Alternatives A, B, or C for the Sweetwater Marsh Unit			
Resource	Alternative A	Alternative B	Alternative C
Wildlife and Fisheries (continued)			
Raptors	No change in existing conditions	No change in existing conditions	No change in existing conditions
Other Land Birds	No change in existing conditions	No change in existing conditions	Restoring 20 acres of native upland would significantly benefit land birds, particularly those associated with coastal sage scrub and maritime succulent scrub habitat.
Mammals	No change in existing conditions	No change in existing conditions	No adverse effects or benefits.
Reptiles/Amphibians	No change in existing conditions	No change in existing conditions	Minor benefits following restoration of Gunpowder Point.
Invertebrates	No change in existing conditions	Slight benefit as a result of improved tidal circulation within the marsh.	Moderate benefit as a result of improved tidal circulation and restored habitat.
Fish	No change in existing conditions	Slight benefit as a result of improved tidal circulation within the marsh.	Moderate benefit as a result of improved tidal circulation and restored intertidal habitat.
Endangered & Threatened Species			
California least tern	No change in existing conditions	Enhancing existing nesting habitat would provide slight benefits.	Enhancing existing nesting habitat and retaining an additional 10 acres of potential nesting area at D Street Fill would provide moderate benefits.
Light-footed clapper rail	No change in existing conditions	Moderate benefits are anticipated as a result of higher quality cordgrass stands following improvements in tidal circulation.	Benefits beyond those provided under Alternative B would result from the restoration of 25 acres of intertidal habitat at D Street Fill.
Salt marsh bird's beak	No change in existing conditions	Moderate benefits due to expanded management of high marsh and improved tidal and freshwater circulation within the marsh.	Same as Alternative B.

Table 4-5 (continued) Summary of Potential Effects of Implementing Alternatives A, B, or C for the Sweetwater Marsh Unit			
Resource	Alternative A	Alternative B	Alternative C
Endangered & Threatened Species (continued)			
California brown pelican	No change in existing conditions	Slight benefits could result from improvements to fisheries related to improved tidal circulation.	Same as Alternative B.
Western snowy plover	No change in existing conditions	Enhancing nesting habitat and improving chick access to foraging habitat would provide moderate benefits.	The benefits described for Alternative B as well as slightly greater benefits from retaining an additional 10 acres of potential nesting area at D Street Fill would be realized under this alternative.
California gnatcatcher	No change in existing conditions	No change in existing conditions	Moderate benefits would result from the restoration of coastal sage scrub habitat on Gunpowder Point.
Public Use			
Hunting/Fishing	No change in existing conditions (Unit closed to hunting/fishing.)	No change in existing conditions	No change in existing conditions
Wildlife Observation/Photography	No change in existing conditions (Opportunities for these uses are provided at Gunpowder Point.)	No change in existing conditions	Realigning the trail and restoring native uplands on Gunpowder Pt. would provide moderate benefits to wildlife observation/photography.
Environmental Education	No change in existing conditions (Opportunities for this use are provided at Gunpowder Point.)	No change in existing conditions	Realigned trail system and new interpretive elements would significantly benefit environmental education programs.
Environmental Interpretation	No change in existing conditions	Moderate benefits would result from new interpretive elements near Paradise Marsh and the F&G Street Marsh.	Realigned trail system and new interpretive elements would significantly improve opportunities for interpretation on the Refuge.
Chula Vista Nature Center	No change in existing conditions	No change in existing conditions	New interpretive elements would complement exhibits at the Nature Center.

Table 4-5 (continued) Summary of Potential Effects of Implementing Alternatives A, B, or C for the Sweetwater Marsh Unit			
Resource	Alternative A	Alternative B	Alternative C
Cultural Resources			
Historic	No change in existing conditions	No change in existing conditions	Modifications to the site of the Hercules Powder Company during habitat restoration could result in an adverse effect, which would require mitigation.
Archaeological	No change in existing conditions	No change in existing conditions	There is a potential for impacts to subsurface deposits. Mitigation would be implemented if resources are discovered that could be impacted by proposed actions.
Socioeconomic			
Land Use/Public Utilities	No change in existing conditions	No change in existing conditions	No change in existing conditions
Traffic/Parking	No change in existing conditions	No change in existing conditions	Slight increases in the demand for parking would not adversely affect current parking availability.
Access/Education/Recreation	No change in existing conditions	No change in existing conditions	Redesigning the existing trail and upgrading the interpretive elements would provide significant benefits to education programs.
Vectors/Odors	No change in existing conditions	Improved tidal circulation would provide slight benefits related to odors and vectors.	Same as Alternative B
Economics/Employment	No change in existing conditions	Several one-time construction projects would provide minor benefits to the economy through the use of private contractors.	Same as Alternative B, plus slight increase in visitors would benefit the local economy.
Environmental Justice	No change in existing conditions	No change in existing conditions	New interpretation would provide moderate benefits.

Table 4-6 Summary of Potential Effects of Implementing Alternatives A, B, C, or D for the South San Diego Bay Unit				
Resource	Alternative A	Alternative B	Alternative C	Alternative D
Physical Environment				
Topography/Visual Quality of the Otay River Floodplain	No change in existing conditions	No change in existing conditions	Moderate changes in the landform would result from filling within the floodplain in areas designated for upland restoration. Limiting the depth of the fill to no more than eight feet would retain public views of the restored floodplain and distance views of the bay and ocean, thus avoiding significant adverse effects to visual quality. Restoring weedy fields with native upland and wetland habitat would provide moderate benefits to the area's visual quality.	Same as Alternative C
Topography/Visual Quality within San Diego Bay	No change in existing conditions	Nesting area enhancements involving minor changes to the levees and filling small portions of the ponds to create new nesting habitat would not represent an adverse or beneficial effect to topography or visual quality.	Converting 200 to 440 acres of salt ponds to intertidal wetlands would alter existing views in the Bay by replacing open water with habitat that is only inundated during high tides. This could be viewed by some as an adverse effect, while others may view this change as inconsequential. Returning the ponds to conditions that better reflect the historic conditions in the bay would not be considered a significant adverse effect to visual quality.	Under this alternative, 650 acres of open water would be converted to intertidal habitat. The conclusions regarding effects to visual quality that are presented for Alternative C would also apply to this alternative.

Table 4-6 (continued) Summary of Potential Effects of Implementing Alternatives A, B, C, or D for the South San Diego Bay Unit				
Resource	Alternative A	Alternative B	Alternative C	Alternative D
Physical Environment(continued)				
Agricultural Lands	No alteration of the existing soils would occur; therefore, no adverse effects to prime farmland would be expected.	Same as Alternative A	Although restoring the Otay River floodplain to native habitat would irreversibly commit Prime Farmland to nonagricultural use, considering the limited economic feasibility of farming this area combined with the limited size of the parcel, the conversion of these lands to native habitat is not considered a significant adverse effect to agricultural resources.	Same as Alternative C
Noise	No change in existing conditions	No change in existing conditions	Grading to implement restoration could result in short-term noise impacts to adjacent homes. Noise attenuating measures would be included in the final restoration plans to reduce potentially significant adverse effects to below a level of significance.	Same as Alternative C
Upstream Flood Characteristics (Otay River Floodplain)	No change in existing conditions	No change in existing conditions	Preliminary modeling result of the Otay River flood characteristics post restoration indicate a slight reduction in upstream backwater effects during a 100-year flood and somewhat lower (1 to 2 feet lower) peak water surface elevations near adjacent development. Therefore, restoration is not expected to exacerbate predicted flood levels upstream of this Refuge Unit.	Same as Alternative C

Table 4-6 (continued) Summary of Potential Effects of Implementing Alternatives A, B, C, or D for the South San Diego Bay Unit				
Resource	Alternative A	Alternative B	Alternative C	Alternative D
Physical Environment(continued)				
Downstream Flood Characteristics (Otay River Floodplain)	No change in existing conditions	No change in existing conditions	Preliminary modeling results of Otay River flood characteristics indicate that under existing conditions the peak water surface elevation at the railroad bridge, which is located at approximately 14.3 feet NAVD88, is 13 feet NAVD88. Under restored conditions, the elevation would be 1 to 2 feet higher. Therefore, the predicted increase in the peak water surface elevation at the railroad bridge could adversely affect the structural integrity of the bridge. Potential adverse effects would be avoided through the implementation of appropriate measures, identified in coordination with the City of San Diego, to protect the integrity of the bridge during a flood event.	Same as Alternative C
Water Quality (Effects of grading)	No change in existing conditions	Grading would be confined to the salt ponds; therefore, no adverse effects to the water quality in the bay are anticipated.	Grading in and around wetland areas could result in increases in siltation and erosion within the watershed. To avoid significant adverse effects to water quality, appropriate Best Management Practices would incorporated into the final restoration design and implemented during restoration.	Same as Alternative C

Table 4-6 (continued) Summary of Potential Effects of Implementing Alternatives A, B, C, or D for the South San Diego Bay Unit				
Resource	Alternative A	Alternative B	Alternative C	Alternative D
Physical Environment(continued)				
Water Quality (Effects of breaching salt pond levees)	No change in existing conditions	No change in existing conditions	Preliminary modeling indicates that temporary increases in turbidity and salinity levels in the south end of the bay are not expected to adversely affect water quality in the bay.	Short term adverse effects (lasting less than a month) could result from breaching the salt ponds; however, the effects to water quality bay wide would be less than significant.
Habitats				
Shallow Subtidal	No change in existing conditions	All enhancement activities would be confined to the salt ponds, which do not support shallow subtidal habitat; therefore, this alternative would have no effect on shallow subtidal habitat.	Short-term, relatively low increases in salinity (approximately 50 ppt during the first ebb tide) would occur immediately to the north of the ponds following pond breaching. These conditions are not expected to adversely impact organisms supported by the adjacent shallow subtidal habitat.	Temporary increases in salinity from pond breaching would be substantially higher (120 ppt) than ambient levels (33 to 40 ppt). Potentially significant short term impacts to shallow subtidal and intertidal mudflat habitat in proximity to the salt ponds could occur. Pre- and post-project monitoring would determine the extent of impact. Most impacts would be more than offset by the conversion of the salt ponds to intertidal habitat. Mitigation for any impacts to eelgrass would be provided in accordance with the Southern California Eelgrass Mitigation Policy.

Table 4-6 (continued) Summary of Potential Effects of Implementing Alternatives A, B, C, or D for the South San Diego Bay Unit				
Resource	Alternative A	Alternative B	Alternative C	Alternative D
Habitats (continued)				
Intertidal (Mudflats and Salt Marsh)	No change in existing conditions	No change in existing conditions	Within the Otay River floodplain, restoration could result in temporary impacts to about 6 acres of intertidal habitat. Four additional acres of high marsh habitat could be lost to implement public use proposals. These impacts would be more than offset by the restoration of between 260 to 525 acres of intertidal wetlands. The proposed restoration would represent a significant benefit to intertidal habitat.	Temporary impacts of up to 6 acres of intertidal habitat could result within the Otay River floodplain and another 2 acres could be impacted as a result of restoration at the salt works. These impacts would be more than offset by the restoration of over 700 acres of intertidal wetlands. The proposed restoration would represent a significant benefit to intertidal habitat.
Freshwater Wetlands	No change in existing conditions	No change in existing conditions	Within the Otay River floodplain, restoration could result in temporary impacts to about 3 acres of freshwater wetland habitat. This impact would be more than offset by the restoration of at least 16 acres of freshwater wetlands. Restoration would represent a moderate benefit to freshwater wetlands.	Same as Alternative C
Upland Habitat	No change in existing conditions	No change in existing conditions	Between 40 and 60 acres of disturbed non-native uplands, dominated by garland chrysanthemum, would be restored to native upland habitat, representing a significant benefit.	Same as Alternative C

Table 4-6 (continued) Summary of Potential Effects of Implementing Alternatives A, B, C, or D for the South San Diego Bay Unit				
Resource	Alternative A	Alternative B	Alternative C	Alternative D
Wildlife and Fisheries				
All Birds	No change in existing conditions	Expanded management within the open bay and a public outreach program to reduce the accumulation of discarded fishing line would provide moderate benefits by reducing the effects of human disturbance to birds in the bay.	Human disturbance in the vicinity of Pond 11 could result from opening the northern levee to public access. Activities would be monitored and if necessary, changes such as seasonal closures would be implemented to reduce unanticipated impacts to below a level of significance.	No public uses adjacent to Pond 11 would occur under this alternative; however, disturbance to birds could result from use of the trail proposed around Pond 28. Mitigation similar to that described for Alternative C would be provided.
Waterfowl	No change in existing conditions	Same as above.	Restoration of coastal wetlands would provide additional foraging habitat for waterfowl. The conversion of some ponds to intertidal habitat could alter current rafting patterns, but the overall effect of restoration is expected to be beneficial.	Same as Alternative C.
Seabirds	No change in existing conditions	Proposals to enhance nesting habitat and provide about 20 acres of new nesting area within the salt ponds would produce moderate benefits for seabirds.	Seabirds would benefit from enhanced and newly created nesting habitat; however, salt pond restoration would eliminate open water areas around traditional nest sites, which could alter nesting patterns for some species. Monitoring and adaptive management is proposed to ensure that existing nesting colonies are not adversely affected.	Same as Alternative C.

Table 4-6 (continued) Summary of Potential Effects of Implementing Alternatives A, B, C, or D for the South San Diego Bay Unit				
Resource	Alternative A	Alternative B	Alternative C	Alternative D
Wildlife and Fisheries (continued)				
Shorebirds	No change in existing conditions	Recontouring of the levee slopes would improve foraging access along the pond edges. In addition, shorebirds that nest at the salt works could benefit from nesting enhancements.	Restoration of coastal wetlands within the Otay River floodplain and the salt ponds would provide additional foraging habitat for shorebirds, representing a significant benefit.	Same as Alternative C
Phalaropes/Eared Grebes	No change in existing conditions	No change in existing conditions	A reduction in the availability of brine invertebrates within the salt ponds could cause phalaropes and grebes to abandon the use of this area during migration. Although this would reduce the diversity and abundance of shorebirds at the salt works, this would not result in significant adverse effects to these species range wide.	Although salt production would be eliminated under this alternative, a managed brine water component has been incorporated into the restoration proposal to ensure the continued availability of brine invertebrates for these species, albeit at a reduced density. The consequences of reducing the availability of brine invertebrates would be the same as described in Alternative C.
Other Waterbirds	No change in existing conditions	No change in existing conditions	Restoration of foraging habitat would represent a significant benefit.	Same as Alternative C

Table 4-6 (continued) Summary of Potential Effects of Implementing Alternatives A, B, C, or D for the South San Diego Bay Unit				
Resource	Alternative A	Alternative B	Alternative C	Alternative D
Wildlife and Fisheries (continued)				
Raptors	No change in existing conditions (some individual raptors could be removed through predator management)	Same as Alternative A	Non-native upland habitat would be replaced with coastal wetlands and native upland habitat, which could reduce the availability of some prey species for raptors. Because the existing habitat is so degraded, restoration is not expected to adversely affect raptors.	Same as Alternative C
Other Land Birds	No change in existing conditions	No change in existing conditions	Restoration of freshwater wetlands and native uplands is expected to benefit a variety of native land birds.	Same as Alternative C
Mammals	No change in existing conditions (some mammals could be removed through predator management)	Same as Alternative A	Conversion of non-native uplands to coastal wetlands would eliminate habitat that supports mammals, but impacts to individual species would be minimal and no adverse affects to overall population size are anticipated.	Same as Alternative C
Reptiles/Amphibians	No change in existing conditions	No change in existing conditions	Grading associated with restoration in the Otay River floodplain could result in the loss of some individuals; however, improved habitat quality following restoration is expected to provide moderate benefits to these organisms.	Same as Alternative C

Table 4-6 (continued) Summary of Potential Effects of Implementing Alternatives A, B, C, or D for the South San Diego Bay Unit				
Resource	Alternative A	Alternative B	Alternative C	Alternative D
Wildlife and Fisheries (continued)				
Invertebrates	No change in existing conditions	No change in existing conditions for terrestrial invertebrates. With the exception of the few invertebrates that tolerate hypersaline conditions, suitable habitat for native invertebrates is not available within the salt ponds. The changes in the ponds to accommodate additional nesting habitat and pelican platforms would have no adverse effects on invertebrates.	Impacts to terrestrial invertebrates due to habitat restoration would be less than significant. The restoration of the salt ponds and Otay River floodplain would provide significant new habitat for many native invertebrates, while habitat for brine invertebrates would be significantly reduced under this alternative.	Impacts to terrestrial invertebrates due to habitat restoration would be less than significant. Temporary increases in salinity levels in the south bay following salt pond breaching could produce short term impacts to invertebrates. Restoration of tidal influence within the ponds, as well as within the Otay River floodplain, would provide new habitat for native invertebrates, which would more than offset short term adverse effects. Areas currently supporting brine invertebrates would be lost. 44 acres of new hypersaline habitat would be created.
Fish	No change in existing conditions	No habitat for fish is provided within the salt ponds. Therefore, pelican platforms and nesting enhancements would not adversely affect fish.	The restoration of the salt ponds and Otay River floodplain would provide new habitat for fish representing a moderate benefit to the bay's fish populations.	Pond breaching is not expected to adversely affect fish populations. Moderate benefits to fish would result from pond restoration. Screening would reduce losses associated with bay water intake.

Table 4-6 (continued) Summary of Potential Effects of Implementing Alternatives A, B, C, or D for the South San Diego Bay Unit				
Resource	Alternative A	Alternative B	Alternative C	Alternative D
Endangered & Threatened Species				
California least tern	No change in existing conditions	Proposed enhancements in nesting substrate and expansion of available nesting sites would provide moderate benefits.	Improvements in available nesting habitat and increased opportunities for foraging in the restored ponds would provide significant benefits.	Similar to Alternative C, but with potentially greater benefits.
Light-footed clapper rail	No change in existing conditions	No change in existing conditions	Significant benefits would result from the restoration of cordgrass-dominated salt marsh habitat in the salt ponds and the overall restoration of coastal wetlands in the Otay River floodplain.	Similar to Alternative C, but with potentially greater benefits.
California brown pelican	No change in existing conditions	Expanded management in the open waters of the bay could reduce disturbance and public outreach to reduce discarded fishing line accumulation would reduce potential losses from entanglement.	Restoration of Ponds 10 and 11 could impact roosting areas if human disturbance increases on pond levees. To reduce the potential for such impacts, monitoring of these roosting areas would be conducted and if necessary fencing or other barriers would be installed to reduce access to these areas. Slight foraging benefits could result from improved fish habitat in the South Bay.	Same as Alternative C.
Western snowy plover	No change in existing conditions	Nesting enhancements, controlling water levels in Pond 20 for nesting, and improving access to foraging areas would provide moderate benefits.	Expanded nesting and foraging opportunities would provide significant benefits.	Same as Alternative C.

Table 4-6 (continued) Summary of Potential Effects of Implementing Alternatives A, B, C, or D for the South San Diego Bay Unit				
Resource	Alternative A	Alternative B	Alternative C	Alternative D
Endangered & Threatened Species (continued)				
Pacific green sea turtle	No change in existing conditions	No change in existing conditions	Slight benefits could be realized as a result of the restoration of some intertidal habitat in the South Bay.	Potential short term adverse effects to eelgrass, which provides habitat for the sea turtles, would be mitigated in accordance with the South California Eelgrass Mitigation Policy. Moderate benefits could be realized as a result of expanded intertidal habitat in the South Bay.
Solar Salt Production				
Solar Salt Production	No change in existing conditions	Slight changes in the operation would result from the construction of new nesting habitat. Production would continue.	Slight to moderate changes in the current operation would occur under this alternative. Production is proposed to continue within a reduced footprint.	This alternative would result in the elimination of solar salt production. Production could be reduced in phases or in one action.
Public Use				
Hunting	No change in existing conditions (The Refuge Unit is closed to hunting.)	No change in existing conditions	No change in existing conditions	No change in existing conditions
Fishing	No change in existing conditions (Fishing is allowed in the bay.)	No change in existing conditions	Onshore fishing in the bay would be permitted from the northern levee of Pond 11.	No change in existing conditions
Wildlife Observation/ Photography	No change in existing conditions (Guided tours are provided on occasion.)	No change in existing conditions	Expanded opportunities for wildlife observation would be provided around the perimeter of the bay and along Pond 11's northern levee.	Expanded opportunities for wildlife observation would be provided around the perimeter of the bay and around Pond 28.

Table 4-6 (continued) Summary of Potential Effects of Implementing Alternatives A, B, C, or D for the South San Diego Bay Unit				
Resource	Alternative A	Alternative B	Alternative C	Alternative D
Public Use (continued)				
Environmental Education	No change in existing conditions (The Habitat Heroes Program)	No change in existing conditions	No change in existing conditions	No change in existing conditions
Environmental Interpretation	No change in existing conditions (no program is currently implement)	No change in existing conditions	No change in existing conditions	Interpretive signage and other elements will be provided along the Bayshore Bikeway, an interpretive trail would be developed around Pond 28, an interpretive program describing the history of hunting on the south bay would be provided seasonally, and an interpretive program to document the significance of solar salt production in the south bay would be developed.
Cultural Resources				
Historic	No change in existing conditions	Minor modifications to the South Bay Salt Works would result in no adverse effects to this resource.	Historic character and function of the South Bay Salt Works would be significantly altered under Salt Works Option 2, representing an adverse effect and requiring mitigation.	Eliminating historic salt production would represent an adverse effect and would require mitigation.
Archaeological	No change in existing conditions	No change in existing conditions	Potential for impacts to subsurface deposits. Mitigation would be implemented if resources are discovered that could be impacted.	Same as Alternative C

Table 4-6 (continued) Summary of Potential Effects of Implementing Alternatives A, B, C, or D for the South San Diego Bay Unit				
Resource	Alternative A	Alternative B	Alternative C	Alternative D
Socioeconomic				
Land Use	No change in existing conditions	No change in existing conditions	No change in existing conditions	No change in existing conditions
Traffic/Parking	No change in existing conditions	No change in existing conditions	Opening the northern levee of Pond 11 to fishing and wildlife observation would increase the parking demand at the Biological Study Area. Coordination with the San Diego County Parks Department would be required.	No increase in parking demands at the Biological Study Area would occur, however, there would be a slight increase in the demand for on-street parking in Imperial Beach associated with new opportunities for wildlife observation and environmental interpretation.
Public Utilities	No change in existing conditions	No change in existing conditions	Coordination with the City of San Diego is required prior to restoration of the Otay River floodplain to ensure protection of existing sewer and water utilities. The temporary relocation of the bicycle path along the Saturn Boulevard right-of-way may be required during restoration.	Same as Alternative C
Access/Education/ Recreation	No change in existing conditions	No change in existing conditions	The western segment of the Otay Valley Regional Park Trail would be accommodated if needed; a boardwalk would be constructed adjacent to the Bayshore Bikeway near Ponds 10 and 23 to improve opportunities for wildlife observation. No existing uses would be eliminated.	Accommodates the regional trail and provides a boardwalk to improve access for wildlife observation. No existing uses would be eliminated.

Table 4-6 (continued) Summary of Potential Effects of Implementing Alternatives A, B, C, or D for the South San Diego Bay Unit				
Resource	Alternative A	Alternative B	Alternative C	Alternative D
Socioeconomic (continued)				
Vectors/Odors	No change in existing conditions	No change in existing conditions	Improved water circulation and new habitat restoration would reduce the availability of breeding areas for freshwater mosquitoes. New habitat for salt marsh mosquitoes would be provided, but the effects are not considered significant. There would also be some potential for occasional odors from the restored wetlands.	Same as Alternative C
Economics/Employment	No change in existing conditions	Slight benefits would result from short term construction work required to implement the nesting enhancements.	Moderate benefits would result from short term construction jobs, but some of these benefits would be offset by reduced employment at the salt works.	Moderate benefits would result from short term contraction jobs, but these benefits would be offset by the loss of 22 jobs at the salt works
Environmental Justice	No change in existing conditions	No change in existing conditions	Increased accessibility to the Refuge would provide moderate benefits to the surrounding underserved communities.	Same as Alternative C

Redevelopment of the West Fairfield Site
The property located to the west of I-5 and east of the Refuge, between Palomar Street and Main Street, is also being considered for redevelopment. This property currently includes the "Fenton Ponds," as well as a variety of industrial, commercial, and residential parcels. Potential uses in this area include low and mid-rise residential development and community-serving commercial development. Issues associated with the future development of this area could include direct and indirect disturbance to wildlife, changes to the existing characteristics of the Otay River floodplain, other changes to the existing hydrology in the area, changes to water and air quality, effects to cultural resources, increased traffic volumes, and potential effects to minority and low-income populations.

Bayshore Bikeway – Western Salt Segment. The Bayshore Bikeway is a 26-mile bicycle facility that when completed will extend along much of the perimeter of San Diego Bay. The Western Salt Segment consists of a Class 1 bikeway that would extend from about Main Street to 13th Street along an existing railroad right-of-way that separates the Otay River floodplain from the salt works. The right-of-way occurs outside the Refuge boundary. Potential issues associated with the future construction of this segment of the bikeway could include disturbance to wildlife, loss or degradation of native habitat, effects to cultural resources, and changes to water quality.

Otay Valley Athletic Complex. The City of San Diego is developing plans for an athletic complex to be located on property within the Otay River floodplain that is situated immediately to the south of the Refuge. The facility, which would be constructed on city-owned property, would encompass approximately 20 acres. The complex could include a recreation center, various types of ball fields, a swimming pool, skate park, and other community-related recreational facilities. Potential issues associated with this project could include changes in the hydrological characteristics of the Otay River floodplain, revisions to the boundary of the Multiple Habitat Planning Area, direct and indirect disturbance of wildlife, changes in water quality, increased traffic volumes, effects to cultural resources, and benefits related to recreation.

City of Imperial Beach Urban Waterfront and Ecotourism Study. A study is currently being conducted to examine possible strategies for increasing tourism within the City of Imperial Beach. This program could lead to some redevelopment within the community, including portions of the community that abuts the Refuge. If implemented, the program could also generate new visitors to the area. Potential issues that could result from programs generated from this study include direct and indirect disturbance to wildlife, increased traffic volumes, benefits to recreation and environmental interpretation, changes in visual quality, and changes in public access.

Redevelopment of Pond 20A. Pond 20A is located to the south of the Refuge and is currently owned by the Port. Preliminary planning for this parcel has been initiated on several occasions. Various uses have been discussed for this area ranging from big-box commercial development to coastal wetland restoration. No plans are currently being reviewed for this parcel. If development were to be considered for a portion of this parcel, potential issues could include changes in the hydrological characteristics of the Otay River floodplain, changes in water quality, loss and/or degradation of wetlands, wildlife disturbance, and changes in visual quality.

Otay Valley Regional Park. The Otay Valley Regional Park is a 13-mile linear park, encompassing some 8,000 acres within the Otay River Valley. The park extends from just east of San Diego Bay to the Otay Lake Reservoirs. The Park will provide significant open space and recreational opportunities for residents within the region. A significant component of the park plan is the regional trail system that will provide a loop trail through the Otay River Valley and around the reservoirs. This primary trail will be intercepted by various connecting trails to provide access to recreational areas, overlooks, and adjacent trail systems. Some of the trail system already exists, while other segments are yet to be constructed. Potential issues associated with the implementation of the trail plan include increased erosion and siltation, loss or degradation of native habitat, disturbance to wildlife, and changes in water quality. Many of these issues will be addressed through adherence to the Otay Valley Regional Park Trail Guidelines.

Otay River Watershed Management Plan and Special Area Management Plan. The County of San Diego, in cooperation with the Port and the Cities of Chula Vista and Imperial Beach, is currently developing a watershed management plan for the Otay River drainage. The plan involves characterizing the watershed's various resources and land uses, identifying goals and objectives, and assessing and prioritizing threats to existing beneficial uses and natural resources. The plan will also provide a strategy to assure high water quality standards and protect natural aquatic and upland resources in the watershed.

The County of San Diego has also obtained federal funds for the development of a Special Area Management Plan (SAMP) for the Otay River watershed. A SAMP is a comprehensive plan intended to provide for natural resource protection and reasonable economic growth within geographic areas of special sensitivity. This comprehensive planning effort is to be used to assist the federal, state, and local regulatory agencies with their decision making and permitting authority to protect aquatic resources. Approval of these plans by the Corps will result in the issuance of General Permits under the Clean Water Act for projects within the Otay River watershed. The SAMP will identify baseline conditions of the watershed including water quality and the extent of wetlands that can be used in other programs.

The SAMP could facilitate development within the watershed that has the potential to result in issues generally related to urbanization of natural areas, including changes in landform, visual quality, hydrology, and air quality; increases in traffic volumes; loss or degradation of native habitat; and effects to cultural resources.

San Diego Bay Integrated Natural Resources Management Plan. This plan, which was sponsored by the U.S. Navy and the Port, presents a long-term management strategy for San Diego Bay. It was prepared to provide direction for the stewardship of the Bay's natural resources, while also supporting the ability of the Navy and Port to meet their missions and continue operating within the Bay. The plan's goal is to "Ensure the long-term health, recovery, and protection of San Diego Bay's ecosystem in concert with the Bay's economic, Naval, recreational, navigational, and fisheries needs. The core strategies of the plan include managing and restoring habitats, populations, and ecosystem processes; planning and coordinating projects and activities so they are compatible with natural resources; improving information sharing, coordination, and dissemination; conducting research and long-term monitoring that supports decision-making; and creating a stakeholder's committee to ensure collaborative, ecosystem-based problem-solving. The

plan contains over 1,000 strategies for achieving better management of the bay, including the protection, enhancement, and restoration of the Bay's coastal habitats. An important objective of the plan is to improve the effectiveness and success of mitigation and enhancement projects by building a consensus of prioritized need among regulators and project proponents.

Coastal Restoration Projects in Southern California. At least three major restoration projects are currently being implemented or planned for the southern California coast, all located within the Pacific Flyway. These include the Bolsa Chica Lowlands Restoration Project, which is currently under construction, the San Dieguito Wetland Restoration Project, which is currently processing the final permits needed to start construction, and the Tijuana Estuary Tidal Restoration Program (TETRP) II project, which is currently in the initial planning phase.

The Bolsa Chica restoration project is located in Orange County, California adjacent to the City of Huntington Beach. The project proposes to restore approximately 600 acres of tidally influenced habitat and create three new nesting areas on 20 acres within the site for federally-listed endangered species.

The San Dieguito Wetland Restoration Project is located in central San Diego County, California, at the western end of the San Dieguito River Valley. This restoration project proposes to restore approximately 150 acres of intertidal habitat and provide 20 acres of nesting habitat for least terns and western snowy plovers.

The Tijuana Estuary Tidal Restoration Program II (TETRP II) proposes to restore coastal wetlands in southern San Diego County, California at the western end of the Tijuana River Valley. The project, which is the second phase of a larger restoration project, will produce a restoration plan for the remaining 480 acres in Friendship Marsh. When implemented, the TETRP II project is expected to restore habitat values that have been lost and improve tidal exchange within the existing and future marsh. A secondary project objective of this project is to identify options for protecting and enhancing the existing barrier beach. The project will attempt to address sand loss and the associated endangerment of critical habitats when high storm waves surge across the depleted dunes and into the salt marsh.

Multiple Species Conservation Planning. Preservation of the San Diego region's biological resources is being addressed through the implementation of regional habitat plans. In southwestern San Diego County, the Multiple Species Conservation Program (MSCP) will preserve a network of habitat and open space in an effort to conserve various species and protect the region's biodiversity. The MSCP is designed to preserve native vegetation and meet the habitat needs of multiple species, rather than focusing preservation efforts on one species at a time.

Several jurisdictions and various special districts are participating in the MSCP including the City of San Diego, City of Chula Vista, and the County of San Diego. These jurisdictions have completed subarea plans that identify core biological resource areas targeted for conservation and describe specific mechanisms for implementing the preserves. To ensure the implementation of the subarea plans and the identified habitat preserves, each jurisdiction has entered into an agreement with the Service and the California Department of Fish and Game. Impacts to biological resources are managed through the various subarea plans. Compliance with the subarea plans along with

conformance to federal and state regulations is intended to reduce cumulative adverse impacts to biological resources to below a level of significance.

4.9.2 Cumulative Effects Analysis

4.9.2.1 Cumulative Effects to the Physical Environment

The majority of the projects included in the cumulative effects analysis involve proposals that would alter the existing topography and visual appearance of the area. Modifications to the existing landform and conversion of existing uses would represent a significant cumulative change in the overall appearance of the southeastern perimeter of the bay. The restoration proposals described for both Refuge Units would contribute to this significant cumulative effect. Whether this effect is considered adverse would vary depending upon the individual observer. Some adverse effects could be mitigated through appropriate site layout, design, and landscaping.

Several projects included in the cumulative effects analysis would alter the existing flood characteristics within the Otay River floodplain. Analysis conducted for the South San Diego Bay Unit Alternatives C and D indicate that the proposed changes associated with restoration would not adversely affect existing development upstream of the project. However, additional cumulative analysis of this and other reasonably foreseeable projects proposed for the floodplain would be conducted prior to completion of final restoration plans for the Refuge to avoid cumulatively significant changes within the floodplain.

As natural areas are converted to urban development, the acreage of impervious surfaces increases, which in turn increases the volume and velocity of urban runoff and decreases water quality. Some of the projects currently being implemented in the vicinity of the Refuge, including the watershed management plan and SAMP will address the extent to which these adverse effects occur. The alternatives proposed for the Refuge that involve restoration of coastal wetlands would also contribute beneficial effects to regional water quality.

Development of the northern portion of the Chula Vista Bayfront Master Plan area would result in the conversion of land identified by the State as Farmland of Local Importance to urban uses. The only parcels remaining in south coastal San Diego County that support designated farmland include the aforementioned parcel, the Otay River floodplain, and several parcels in the Tijuana River Valley. The conversion of the Bayfront parcel and restoration of the Otay River floodplain parcel (a portion of the South San Diego Bay Unit designated as Prime Farmland) would therefore represent a significant cumulative loss of important farmland in coastal San Diego County.

Impacts from construction, particularly earthmoving operations, although relatively short in duration, would contribute incrementally to the overall concentration of fugitive dust and particulate matter in the air. The contributions from the proposed restoration options are not however considered cumulatively significant.

4.9.2.2 Cumulative Effects to Biological Resources

Many of the projects being considered for implementation in the vicinity of the Refuge could result in disturbance to the wildlife. Some of the public uses proposed on the South San Diego Bay Unit could also result in disturbance to wildlife if appropriate controls such as seasonal restrictions are not imposed. Several alternatives for the Refuge would also result in the restoration of habitat that would provide new habitat areas well removed from human disturbance. Therefore, the incremental adverse effects of introducing some public uses onto the Refuge would be offset by the provision of significant acreage of new habitat areas.

The restoration proposals included within several of the action alternatives evaluated for the Refuge would represent a substantial incremental increase in the amount of intertidal habitat within San Diego Bay, as well as an incremental increase in the amount of wetland habitat within the Pacific Flyway. The combination of the Sweetwater Marsh Unit Alternative C and the South San Diego Bay Unit Alternative D would provide the most significant contribution. Combined with the other restoration projects under consideration in Southern California, the action alternatives would result in substantial positive cumulative effects to fish and wildlife. The action alternatives would also incrementally increase the quality and availability of nesting habitat for the California least tern and western snowy plover, that combined with the other proposals to expand the availability of nesting habitat, would result in substantial positive cumulative effects to these listed species.

4.9.2.3 Cumulative Effects to Cultural Resources

Adherence to the policies and regulations pertaining to the protection of cultural resources would avoid or mitigate any significant adverse effects as a result of implementing any of the action alternatives. However, the elimination of solar salt production, as proposed in Alternative D for the South San Diego Bay Unit, would contribute to the cumulative loss or alteration of historic properties within San Diego County.

4.9.2.4 Social and Economic Environment

Several of the projects being considered for development in the vicinity of the Refuge could generate significant traffic volumes affecting the local and regional street systems. None of the alternatives considered for the Refuge would contribute cumulatively to localized or regional traffic impacts.

Coordination with the City of San Diego regarding the protection of existing public utilities in the Otay River floodplain would avoid any significant effects; therefore, the no cumulative effects from the implementation of the CCP are anticipated.

Several of the projects proposed in the vicinity of the Refuge would provide new opportunities for recreation. Implementation of Alternatives C or D for the South San Diego Bay Unit would also provide additional opportunities for recreation, therefore, representing a significant beneficial cumulative effect on the surrounding community and the region.

The alternatives proposed for this Refuge would not result in any incremental increases in the vector population in the South Bay; therefore, no cumulative effects are anticipated. Any increase in odors that could be detected by adjacent residents during restoration would be short in duration and would not represent a cumulative effect.

The implementation of several of the action alternatives for the South San Diego Bay Unit would result it the loss of some or all of the 22 jobs at the South Bay Salt Works. A few of these losses would be offset by the proposed increase in staffing within the Refuge to manage the restored habitats. The enhancement and restoration proposals included in the action alternatives would also result in short term construction jobs that would represent a minor contribution to the regional economy. These incremental changes in the regional work force, although significant to the affected individuals, would not represent a cumulative effect.

The action alternatives, particularly those involving expansion of wildlife dependent recreational uses and improvements to water quality that would occur as a result of wetland restoration, would provide beneficial effects to the residents of the communities that surround the Refuge. In

addition, the environmental education programs to be provided would continue to emphasize outreach to underserved communities. These effects would provide incremental positive cumulative effects related to environmental justice.

4.10 Irretrievable and Irreversible Commitment of Resources

Most management actions identified in this document would require a commitment of funds (refer to Appendix D) that would then be unavailable for use on other Service projects. At some point, commitment of funds to these projects would be irreversible, and once used, these funds would be irretrievable. Non-renewable or non-recyclable resources committed to projects identified in this CCP, such as fuel for Refuge vehicles, supplies used in management or maintenance activities (e.g. herbicide, fencing, signs, etc.), and fuel for construction equipment used to implement enhancement and restoration projects, would also represent irreversible and irretrievable commitments of resources.

Finally, the restoration of the Otay River floodplain would convert up to about 50 acres of land designated by the State as Prime Farmland to intertidal wetlands. This would represent an irreversible and irretrievable commitment of potential farmland to native habitat.

4.11 Short-Term Uses and Long Term Productivity

An important goal of the National Wildlife Refuge System is to maintain the long-term ecological productivity and integrity of the biological resources on NWRs. This system-wide goal is the foundation for the goals presented in this CCP.

All of the alternatives proposed for the Sweetwater Marsh Unit favor actions that would ensure the long term productivity of the Refuge's resources. Several public uses were considered for evaluation but eliminated from detail study in part because the uses were not found to be compatible with Refuge purposes (refer to Appendix K).

For the South San Diego Bay Unit, some alternatives, such as Alternatives B and D, favor long term productivity over short term uses by minimizing public uses and focusing on endangered species protection and recovery. Alternative D also proposes to displace solar salt production to increase the overall productivity of the salt ponds, including the bittern and crystallizer ponds that currently provide little in terms of quality habitat for Refuge resources. Restoring long-term productivity to the salt ponds through the reintroduction of tidal circulation would however result in a reduction in the total density of brine invertebrates available within the current system. Alternative C attempts to balance short-term uses (i.e., solar salt production and additional recreational opportunities), while still increasing the long-term productivity of the primary salt ponds.

4.12 Unavoidable Adverse Effects

None of the alternatives considered for the Sweetwater Marsh Unit would be expected to result in unavoidable adverse environmental effects. Where the potential for such effects has been identified, appropriate mitigation measures have been incorporated into the project scope to reduce the effects to below a level of significance. In addition, monitoring of Refuge resources would be conducted as part of any proposed management action to enable Refuge staff to adapt management policies should unforeseen problems arise.

For the South San Diego Bay Unit, the proposal to restore the Otay River floodplain to native habitat, as described in both Alternative C and Alternative D, would result in an unavoidable adverse effect to agricultural resources. However, the loss of this area to agricultural use is not

considered regionally significant, because this area has not been in agricultural production in many years, the size of the affected area is relatively small (approximately 50 acres), and returning this area to protection would have limited economic feasibility. Other potentially significant adverse effects associated with the implementation of the alternatives proposed for the South San Diego Bay Unit would be mitigated to below a level of significance through specific mitigation measures and/or phasing and adaptive management.

Chapter 5 - Compliance, Consultation, and Coordination with Others

5.1 Compliance

In undertaking a proposed action, the Service must comply with various Federal laws, Executive Orders, regulations, and other guidance pertinent to a Federal action. The Executive Orders and legislative acts listed below have been or will be complied in association with the implementation of the Final CCP.

5.1.1 Agency Coordination

Executive Order 12372, Intergovernmental Review of Federal Programs. Federal agencies are required to provide opportunities for consultation to State and local governments that would be directly affected with a Federal action. *Coordination and consultation is ongoing with State agencies, Tribes, congressional representatives, other Federal agencies, and the local governments that surround these refuges. These entities were also provided with copies of the Draft CCP/EIS for review and comment.*

5.1.2 Human Rights Regulations

Executive Order 12898, Environmental Justice. Federal agencies are mandated to achieve environmental justice by identifying and addressing disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. *Environmental justice is addressed in Section 4.7.7 of the Draft CCP/EIS, which states that various management alternatives analyzed for each refuge would not cause disproportionately high and adverse human health impacts in any population, nor would any alternative create a greater burden on low-income households.*

Americans with Disabilities Act of 1990 (ADA). Discrimination is prohibited on the basis of disability in employment, State and local government, public accommodations, commercial facilities, transportation, and telecommunications. *The actions and projects described in the CCP management alternatives would be implemented in compliance with ADA requirements.*

5.1.3 Cultural Resources Regulations

Section 4.6 of the Draft CCP/EIS describes how the proposed management alternatives would be implemented to comply with the following Executive Order and relevant cultural resources regulations.

Executive Order 11593, Protection and Enhancement of the Cultural Environment. The Service is required to comply with Section 106 of the National Historic Preservation Act of 1966, as amended, by consulting with Federal and State Historic Preservation Officers when development activities are proposed that would affect the archaeological or historical sites.

Executive Order 13007, Indian Sacred Sites. This order provides for access to and ceremonial use of Indian sacred sites on Federal land used by Indian religious practitioners and directs Federal land managers to avoid adversely affecting the physical integrity of such sacred sites.

Antiquities Act of 1906. This act authorizes the scientific investigation of antiquities on Federal land; prohibits and provides penalties for unauthorized search for or collection of artifacts or other objects of scientific interest; and authorizes the president to establish national monuments and cultural areas on Federal lands.

National Historic Preservation Act of 1966, as amended (PL 89-665; 50 STAT 915; 16 USC 470 et seq.: 36 CFR 800) (NHPA). Federal agencies are directed to take into account the effects of their actions on items or sites listed or eligible for listing in the National Register (Section 106). Section 110(a) sets inventory, nomination, protection, and preservation responsibilities for federally owned cultural properties.

American Indian Religious Freedom Act of 1978 (PL 95-341; 92 STAT 469; 42 USC 1996). This act protects and preserves the right of American Indians to believe, express, and exercise their traditional religions, including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.

Archaeological Resources Protection Act of 1979, as amended (PL 96-95; 93 STAT 722; 16 USC 470aa-47011) (ARPA). This Act protects archeological resources on public lands.

Native American Graves Protection and Repatriation Act of 1990 (PL 101-601; 25 USC 3001 et seq.) (NAGPRA). Federal agencies are required to provide information about Native American cultural items (e.g., human remains, funerary objects, sacred objects, and objects of cultural patrimony) to parties with standing, such as lineal descendants, culturally affiliated Indian tribes, or Native Hawaiian organizations, and, upon presentation of a valid request, dispose of or repatriate these objects to them.

5.1.4 Biological Resources Regulations

Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds. This order instructs Federal agencies to conserve migratory birds by several means, including the incorporation of strategies and recommendations found in Partners in Flight Bird Conservation Plans, The North American Waterfowl Plan, the North American Waterbird Conservation Plan, and the United States Shorebird Conservation Plan, into agency management plans and guidance documents. *The recommendations and strategies to conserve migratory birds that are contained in the various migratory bird conservation plans have been incorporated into the goals, objectives, and strategies for the two refuges, as presented in Chapter 2 of the Draft CCP/EIS.*

Executive Order 13112, Invasive Species. Federal agencies whose actions may affect the status of invasive species are required to use relevant programs and authorities to prevent, control, monitor, and research such species and coordinate complementary, cost-efficient, and effective activities concerning invasive species by relying on existing organizations already in place that address invasive species issues. *The control of invasive, exotic weeds is proposed in all of the management alternatives described in the Draft CCP/EIS.*

Migratory Bird Treaty Act of 1918, as amended (MBTA). This Act provides protection for bird species that migrate across state and international boundaries. *The Service's Division of Migratory Birds and Habitats Program was consulted during the preparation of the management alternatives and the draft Predator Management Plan, and the actions described in the alternatives proposed for each Refuge Unit were reviewed for consistency with the requirements of the Act.*

Fish and Wildlife Act of 1956, as amended (16 U.S.C. §§742a-742j, not including 742d-742l). This act provides the Secretary of the Interior with authority to protect and manage fish and wildlife resources and provides direction to administer the act with regard to the inherent right of every citizen and resident to fish for pleasure, enjoyment, and betterment and to maintain and increase public opportunities for recreational use of fish and wildlife resources. *Compatibility determinations were conducted for a variety of wildlife-dependent recreational uses, including fishing, wildlife observation and photography, and environmental education and interpretation.*

Endangered Species Act of 1973, as amended (16 USC 1531 et seq.) (ESA). This act provides for the conservation of ecosystems upon which threatened and endangered species of fish, wildlife, and plants depend, both through Federal action and by encouraging the establishment of State programs. Section 7 of the ESA requires Federal agencies to insure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of listed species or modify their critical habitat. *An internal Section 7 consultation has been initiated. An analysis of potential adverse effects to federally listed species (Section 4.5 of the Draft CCP/EIS) found that implementation of the management alternatives described in the Draft CCP/EIS would not adversely affect listed species.*

5.1.5 Land and Water Use Regulations

Executive Order 11988, Floodplain Management. Federal agencies are prohibited from contributing to the "adverse impacts associated with the occupancy and modification of floodplains" and the "direct or indirect support of floodplain development." In addition, before proposing, conducting, supporting, or allowing an action in a floodplain, each agency is to determine if planned activities will affect the floodplain and evaluate the potential effects of the intended actions on its functions. *The potential upstream effects of restoring wetlands within the Otay River floodplain are evaluated in Section 4.2.2.3.3 and Appendix I of the Draft CCP/EIS. Based on this analysis, the potential for flooding upstream of the South San Diego Bay Unit would not increase as a result of restoration, and in some cases, flood elevations would be expected to be somewhat lower. Additional analysis would be conducted when more specific restoration plans are developed for the South San Diego Bay Unit.*

Executive Order 11990, Protection of Wetlands. Each agency shall provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and preserve and enhance the natural and beneficial values of wetlands when conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities. *All of the management alternatives described in the Draft CCP/EIS would result in the protection of the existing wetlands within each Refuge Unit. Some of the alternatives also include proposals to improve and/or restore current wetland habitat values.*

Executive Order No. 12996, Management and General Public Use of the National Wildlife Refuge System. This order directs the Secretary of the Interior to recognize compatible wildlife-dependent recreational activities involving hunting, fishing, wildlife observation and photography, and environmental education/interpretation as priority general public uses on the refuge system. *As part of the development of the CCP, the Service completed compatibility determinations for various wildlife-dependent recreational activities, including existing uses and new uses suggested by the public.*

Refuge Recreation Act of 1962, as amended. This act authorized the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use, when such uses do not interfere with the area's primary purposes. *The compatibility determinations prepared as*

part of the development of the CCP included an evaluation of whether or not the proposed use was compatible with the purposes for which the particular refuge was established.

National Wildlife Refuge System Act of 1966, as amended (16 USC 668dd-668ee). This act requires that refuges are managed as a national system of related lands, waters, and interests for the protection and conservation of our Nation's wildlife resources. Any use of a refuge is permitted provided "such uses are compatible with the major purposes for which such areas were established." *The Draft CCP has been prepared in accordance with this act and complies with the requirement that only compatible uses be permitted on a refuge.*

Coastal Zone Management Act of 1972 (16 USC 1451-1464). This act requires that all Federal actions proposed in the coastal zone be conducted in a manner consistent with the approved coastal zone management plan. *Following distribution of the Draft CCP/EIS, a request for a consistency determination will be submitted to the California Coastal Commission.*

Federal Water Pollution Control Act of 1948, as amended (33 U.S.C. 1251 - 1376; Chapter 758; P.L. 845; 62 Stat. 1155) (Clean Water Act). This act established the basic structure for regulating discharges of pollutants into the waters of the United States. Section 402 of the act established the National Pollutant Discharge Elimination System (NPDES) to authorize EPA issuance of discharge permits (33 U.S.C. 1342) and Section 404 authorized the U.S. Army, Corps of Engineers to issue permits for the discharge of dredged or fill material into navigable waters at specified disposal sites (33 U.S.C. 1344). *Prior to the implementation of any wetland restoration projects within the Refuge, the appropriate permits related to the Clean Water Act would be obtained. Best Management Practices would be implemented during restoration to avoid or minimize the potential for adverse effects to water quality in San Diego Bay and adjacent wetlands.*

5.1.6 Tribal Coordination

Executive Order 13175, Consultation and Coordination with Indian Tribal Governments. This order requires Federal agencies to implement an accountable process to ensure meaningful and timely input by tribal officials as policies are developed that have tribal implications. *Twenty-two Federally-recognized Tribes and other tribal organizations were contacted to solicit comments and initiate consultation with respect to the development of the Draft CCP/EIS and various proposed actions evaluated within the document.*

5.1.7 Wilderness Review

Wilderness Act of 1964 (16 U.S.C. 1131-1136, 78 Stat. 890). The Wilderness Act of 1964 directed the Secretary of the Interior, within 10 years, to review every roadless area of 5,000 or more acres and every roadless island (regardless of size) within National Wildlife Refuge and National Park Systems and to recommend to the President the suitability of each such area or island for inclusion in the National Wilderness Preservation System. Refuge planning policy requires a wilderness review concurrent with the CCP process [602 FW 3(1)(c)]. The wilderness review process consists of three phases: inventory, study, and recommendation. The inventory is a broad look at the refuge to identify lands and waters that meet the minimum criteria for wilderness. The study evaluates all values (ecological, recreational, cultural), resources (e.g., wildlife, water, vegetation, minerals, soils), and uses (management and public) within the Wilderness Study Area. The findings of the study determine whether or not the area should be recommended for designation as wilderness. *The Service lands and waters within the planning area have been inventoried and no areas were found that meet the eligibility criteria for a Wilderness Study Area as defined by the Wilderness Act. Therefore, potential wilderness designation of lands and waters within the San Diego Bay*

NWR is not analyzed further in the CCP. The results of the wilderness inventory are documented in Appendix N.

5.2 Public Involvement, Consultation, and Coordination

5.2.1 Public Outreach Summary

The following summarizes the public outreach that has occurred for this CCP, including initial scoping meetings, public workshops, posting information on the Refuge Complex website, interagency meetings, planning update mailings, Federal Register notices, and an overview of the topics discussed or comments received. The CCP distribution list is provided in Appendix B and a summary of the public comments provided during initial scoping and at the public workshops is provided in Appendix E.

5.2.1.1 Initial Scoping Meetings

Provided below is a summary of two scoping meeting held to initiate the CCP process.

Date and Location of the Meeting: Monday, July 10, 2000 (7:00-9:00 PM) at the Marina Vista Center in Imperial Beach, California.
Notification Process: Federal Register, Planning Update #1 (mailing list includes >1,000 individuals, agencies, and organizations), Letter to Affected Federal, State and Local Agencies, Press Release.
Purpose: Initial scoping meeting to solicit public comment and participation in the process.
Format: Welcome and overview presentation followed by an open house style format with various topic tables and Service staff available to answer questions and record comments. Table topics included: general information about Refuges, the CCP process, public use, refuge operations, and wildlife management and endangered species.
Number of Participants (excluding Service staff): 45
Audience: Public, Government Agency Representatives, Local Elected Officials, and Non-governmental Organizations.
Topics Discussed: Future land acquisitions, boundary expansion, public use, research, bay-wide coordination of interpretive signage, species inventories, existing habitat preservation, adaptive management, habitat restoration, endangered species, invasive species, and predator control.
Follow Up: A letter, dated September 20, 2000, was distributed to all participants to invite them to the next set of public workshops.

Date and Location of the Meeting: Tuesday, July 11, 2000 (1:30–3:30 PM) at the Chula Vista Nature Center Auditorium, Chula Vista, California.
Notification Process: Federal Register, Planning Update #1, Letter to Affected Federal, State and Local Agencies, Press Release.
Purpose: Initial scoping meeting to solicit public comment and participation in the process.
Format: Same format as described above.
Number of Participants (excluding Service staff): 24
Audience: Public, Government Agency Representatives, and Non-governmental Organizations.
Topics Discussed: Similar to above, as well as procedural issues related to the make up of the CCP team, adjacent development proposals, and planning for the Stewardship Project.
Follow Up: Same as above.

5.2.1.2 Public Workshops

Provided below is a summary of the various public workshops held to address specific issues related to the CCP.

Date and Location of the Meeting: Thursday, September 28, 2000 (6:30-9:00 PM) Imperial Beach Community Room, Imperial Beach, California.
Notification Process: Postcard (using updated mailing list), Press Release, Letter to participants of the initial scoping meetings, Announcement in the San Diego Union Tribune.
Purpose: Public Use Workshop
Format: Opening presentation, followed by a facilitated question and comment period.
Number of Participants (excluding Service staff): 23
Audience: Public, Government Agency Representatives, and Non-governmental Organizations.
Topics Discussed: Public access, trails, viewing areas, hunting, fishing, boating, dog trials, environmental education, and interpretation.
Follow Up: A letter, dated October 13, 2000, was distributed to all participants that included a reminder about the next workshop and provided a summary of the comments received at the September 28 meeting.

Date and Location of the Meeting: Thursday, November 2, 2000 (6:30-9:00 PM) Chula Vista City Hall Conference Room, Chula Vista, California.
Notification Process: Postcard (using updated mailing list), Follow-up Notice to Past Workshop Participants, Press Release, Article in the San Diego Union Tribune.
Purpose: Wildlife Management/Restoration Workshop
Format: Formal presentation, followed by a facilitated question and comment period.
Number of Participants (excluding Service staff): 30
Audience: Public, Government Agency Representatives, and Non-governmental Organizations.
Topics Discussed: Priorities for habitat management, the need to develop a baseline data base for each refuge, predator control, invasive species, maintaining existing habitat values on the salt pond levees for nesting seabirds, brine invertebrates, water quality, and coordination of refuge planning with other habitat planning in the region.
Follow Up: A letter, dated December 19, 2000, was sent to the participants thanking them for their involvement and providing a summary of the comments heard at the November 2 workshop.

Date and Location of the Meeting: Thursday, March 1, 2001 (6:30-9:00 PM) Imperial Beach Community Room, Imperial Beach, California.
Notification Process: Postcard (using updated mailing list), Follow-up Notice to Past Workshop Participants, Press Release, Announcement in the San Diego Union Tribune.
Purpose: Refuge Goals/Objectives and Salt Works Restoration Workshop
Format: Formal presentation, followed by a question and comment period.
Number of Participants (excluding Service staff): 54
Audience: Public, Government Agency Representatives, Local Elected Officials, and Non-governmental Organizations.
Topics Discussed: Need for hydrologic studies, predator control, seabird nesting, contaminants, restoration phasing, endangered species, and long-term maintenance.
Follow Up: The information presented at the workshop was posted on the Refuge website and additional comments were solicited.

Date and Location of the Meeting: Tuesday, May 22, 2001 (6:30-9:00 PM) Imperial Beach Community Room, Imperial Beach, California.
Notification Process: Mailer (using updated mailing list), Press Release, Announcement in the San Diego Union Tribune.
Purpose: Restoration Workshop
Format: Formal presentation, followed by a public comment period.
Number of Participants (excluding Service staff): 25
Audience: Public, Government Agency Representatives, and Non-governmental Organizations.
Topics Discussed: Avoidance of existing high value habitat during restoration, maintaining a brine invertebrates for migratory birds, restoration of tidal exchange in some ponds, protection of endangered species, phase restoration, and enhancement of habitat for seabird nesting.
Follow Up: Continued to encourage comments through the Refuge's webpage.

Date and Location of the Meeting: Thursday, June 21, 2001 (6:30-9:00 PM) Chula Vista City Council Chambers, Chula Vista, California.
Notification Process: Mailer (using updated mailing list), Press Release.
Purpose: Public Use Workshop
Format: Formal presentation, followed by a facilitated public comment period.
Number of Participants (excluding Service staff): 50
Audience: Public, Government Agency Representatives, and Non-governmental Organizations.
Topics Discussed: Refuge policies related to public use, existing public uses, potential public uses on the refuges, hunting, fishing, dog trials, boating, and public access on the refuges.
Follow Up: Planning Updates # 2 and # 3 addressed the topic of public use.

5.2.1.3 Interagency Coordination Meeting

An interagency meeting was also held to provide various local, state, and federal agencies with an overview of the CCP. The specifics of that meeting are presented below.

Date and Location of the Meeting: Thursday, September 7, 2000 (1:00-4:00 PM) Imperial Beach Community Room, Imperial Beach, California.
Notification Process: Letter Invitation to Participants.
Purpose: Interagency Coordination Meeting
Format: Welcome and overview presentation, open discussion among agency representatives, public comment.
Number of Participants (excluding Service staff): 16 agency representatives, and 6 members of the public.
Audience: Public agencies representatives, members of the public were present and some provided comment during a public comment period.
Topics Discussed: Overview of the CCP process, review of the role of each agency in the process, and overview of interim refuge goals.

5.2.1.4 Planning Updates

Date: June 2000, Planning Update #1
Purpose: To announce the initiation of the CCP process, invite the public to participate, publicize the dates of the initial scoping meetings, present an overview of the NWRS and

the Sweetwater Marsh NWR and the South San Diego Bay Unit, and provide public contact information.
Number of Recipients: >1,000 (also posted on the Refuge website)

Date: October 2001, Planning Update #2
Purpose: To provide information regarding refuge goals, restoration planning, and public use and to briefly summarize the public participation process.
Number of Recipients: >1,000 (also posted on the Refuge website)

Date: March 2002, Planning Update #3
Purpose: To address public use issues, particularly waterfowl hunting.
Number of Recipients: >1,000 (also posted on the Refuge website)

Date: July 2003, Planning Update #4
Purpose: To describe the alternatives to be analyzed in the Draft CCP/EIS.
Number of Recipients: >1,000 (also posted on the Refuge website)

Date: April 2005, Planning Update #5
Purpose: To announce the Refuge name change and describe the public review process.
Number of Recipients: >1,000 (also posted on the Refuge website)

5.2.1.5 Federal Register Notices

Date of Notice: June 23, 2000, listing in the Federal Register
Purpose: Notice of Intent to Prepare a Comprehensive Conservation Plan and Associated NEPA Document
Audience: National
Contents of the Notice: Public notice of initiation of the planning process for the refuges, solicitation of written comments, and announcement of public workshops/open houses.

Date of Notice: April 22, 2002, listing in the Federal Register
Purpose: Revised Notice of Intent to Prepare a Comprehensive Conservation Plan and Associated NEPA Document
Audience: National
Contents of the Notice: Public notice of the Service's intent to prepare an Environmental Impact Statement in association with the CCP.

5.2.1.6 Tribal Consultation and Coordination

In February 2002, a letter was sent to 22 Tribal governments and other tribal organizations regarding the CCP process and encouraging participation in the development of the CCP. All Planning Updates and public notices related to the CCP process were also provided. In June 2004, a second letter was sent to provide a CCP update, summarize the management alternatives being evaluated in the Draft CCP/EIS, and encourage involvement in the process.

5.2.1.7 Consultation and Coordination with Others

Since scoping was initiated for this CCP in June 2000, the CCP planning team has consulted with various agencies, outside consultants, and academia to ensure a comprehensive evaluation of the various management alternatives presented in the Draft CCP/EIS. The team has also coordinated with other Federal, State, and local agencies, non-governmental organizations, and the public to keep them updated on the progress of the CCP and the issues being considered during the development of the CCP. Some of the entities that have been involved in the process include:

- California Department of Fish and Game – An invitation to participate in the CCP process was formally extended to the Department in a letter dated August 10, 2000. The Department has assisted in issues related to restoration and public use.

- NOAA Fisheries – This agency was represented as several public workshops, the South Bay interagency coordination meeting, and provided technical assistance in the evaluation of specific restoration proposals.

- U.S. Navy - The Service coordinated with the Navy on several occasions to address issues related to public use. In addition, the Navy provided invaluable data regarding the resources in San Diego Bay and participated in the South Bay interagency coordination meeting.

- Regional Water Quality Control Board – Several meetings have been held with staff from the Regional Board to review the potential effects of levee breaching on water quality within San Diego Bay.

The CCP planning team has also coordinated with the U.S. Coast Guard, California State Lands Commission, Unified Port of San Diego, San Diego County Airport Authority, County of San Diego, Cities of Chula Vista, Coronado, Imperial Beach, National City, and San Diego, South Bay Salt Works, and others. The expertise of agency, university, and consulting restoration biologists, wildlife biologists, entomologists, and others were sought to assist the team in evaluating issues related to salt pond restoration, brine invertebrate production, and coastal salt marsh restoration. In addition, using funds provided by the Service's Coastal Program Philip Williams and Associates, Ducks Unlimited, Inc, and Everest International Consultants, Inc. were retained to assist in hydrologic modeling and restoration engineering.

5.3 Acknowledgements

Over one hundred people and numerous non-governmental organizations have contributed in some way to the development of this CCP. Although it is not possible to name them all, we would like to acknowledge the time and energy that they have expended to express their views and comments, support the process, and appreciate and enjoy the resources included within these Refuge Units.

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Elizabeth Copper	Chris Nordby	Dr. Richard Zembal
Barbara Hemmingsen	Robert Patton	

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