

# Chapter 8. Biological Resources

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## Introduction

Biological resources evaluated for the proposed alternatives include native and non-native aquatic and terrestrial habitats, special-status communities, special-status plant and animal species, and species groups of high recreational interest. This chapter describes existing biological resources present in the HAAF, SLC, and BMKV parcels and potential impacts on biological resources that may occur with implementation of project alternatives.

## Affected Environment

### Data Sources

Information presented in this section is based on the following data sources:

- ◆ Environmental Impact Statement—Hamilton Army Airfield Disposal and Reuse (U.S. Army Corps of Engineers 1996a) and
- ◆ Bel Marin Keys Unit 5 Final Environmental Impact Report/Environmental Impact Statement (Environmental Science Associates 1993).

Common and scientific names of plant and animal species mentioned in the text are presented in Appendix D.

### Biological Communities

Subtidal aquatic, intertidal, wetland, and grassland communities and developed areas are the habitats present in the HAAF, SLC, BMKV parcels. A substantial portion of the BMKV parcel is agricultural land. These habitats and the associated plant and wildlife species are described below. The distribution of habitat types within each area is presented in Figure 8-1, and the acreage of each habitat type in each area is presented in Table 8-1. Habitat types and acreages are derived from the results of previous habitat inventories conducted of the project area.

## **Aquatic Communities**

Aquatic communities include subtidal (i.e., aquatic habitats that are never exposed during low tide) and intertidal aquatic (i.e., emergent marsh habitat and mudflats that are exposed during low tides) habitats. Each of these is described below.

**Subtidal Aquatic Habitat.** Subtidal aquatic habitats are areas of continuous open water that are submerged during even the lowest tide; as a result, these areas are too deep to support the types of vegetation found in emergent (i.e., occasionally exposed) marsh habitat. Phytoplankton; zooplankton; and fish such as longfin smelt, northern anchovy, speckled sanddab, and staghorn sculpin occupy subtidal aquatic habitat. Benthic organisms such as worms and clams can be found in the sandy, muddy bottom. Many species of waterfowl and diving birds use subtidal aquatic habitat for feeding areas.

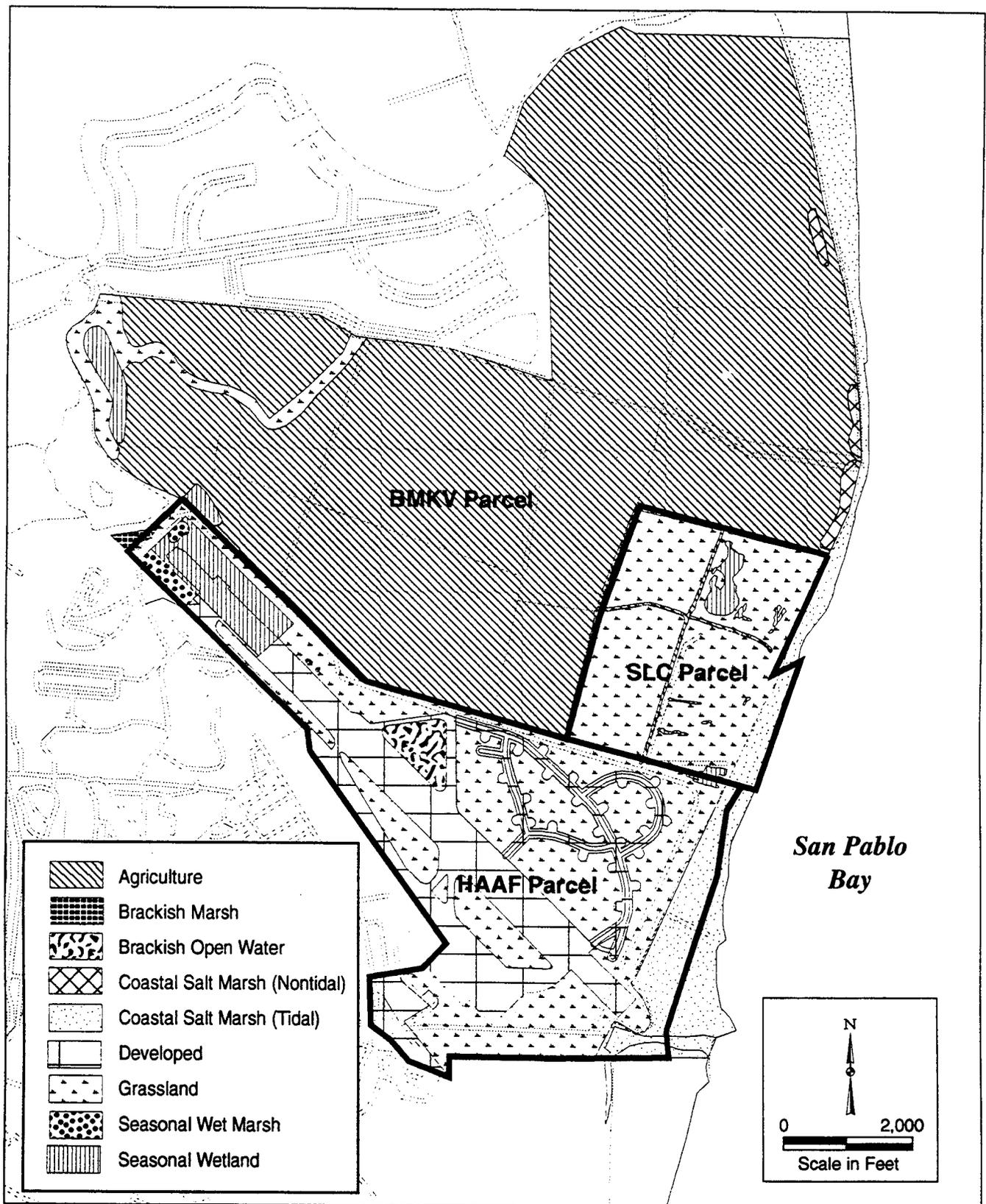
**Intertidal Aquatic Habitat.** Intertidal aquatic habitat comprises two subtypes of habitat, intertidal mudflats and coastal salt marsh. Intertidal mudflats are made up of unconsolidated, muddy bottom areas without vegetation and are present along the bay side of coastal salt marshes that are outboard (on the bay side) of the perimeter levee. Mudflats are exposed twice daily during low tide and extend to the extreme low water elevation (Figure 8-2). Narrow bands of mudflat are also found at the same elevations along the margins of subtidal channels in tidal marshes. Mudflats are highly productive and support large populations of benthic (bottom-feeding) organisms, including aquatic worms, crustaceans, and mollusks that are important elements of the estuarine foodweb. When exposed or covered by shallow water, mudflats provide important foraging areas for migrant and wintering shorebirds, wading birds, and gulls.

Coastal salt marsh contains persistent, rooted herbaceous vegetation dominated by cordgrass and pickleweed. The vegetation in the marsh habitat is used as direct cover and sources of food by rearing juvenile and adult fish such as longfin smelt, chinook salmon, and steelhead. Because emergent marsh habitat is within the tidal zone, it drains frequently and, for this reason, is not used for spawning. Benthic organisms use this habitat in the same way they use intertidal mudflats. Emergent marsh habitat also provides nesting, foraging, and escape cover for various songbirds and wading birds.

## **Wetland Communities**

Five types of wetland communities are present in the project area: coastal salt marsh (tidal), coastal salt marsh (nontidal), brackish marsh, brackish open water, and seasonal wetland. All of these wetland types except brackish open water are considered jurisdictional wetlands by the U.S. Army Corps of Engineers (Corps) in accordance with the federal Clean Water Act and as sensitive natural communities by the California Department of Fish and Game (DFG).

Boundaries of wetland communities in the HAAF parcel were established during a delineation of potential jurisdictional wetlands in 1991 (Jones & Stokes Associates 1991). The delineation was initially verified by the San Francisco District of the Corps in 1992



Jones & Stokes Associates, Inc.

**Figure 8-1**  
**Habitat Types at the Hamilton Wetland**  
**Restoration Project Site**

**Table 8-1.**

**Acreege of Each Habitat Type in the HAAF, SLC, and Bel Marin Keys V Parcels**

Habitat Type	HAAF	SLC	Subtotal	Bel Marin Keys V	Total
Coastal salt marsh (tidal)	88.0 <sup>a</sup>	32.0 <sup>b</sup>	120.0	0.0	120.0
Coastal salt marsh (nontidal)	0.0	0.0	0.0	11.0	11.0
Brackish marsh	4.1	0.0	4.1	27.0	31.1
Brackish open water	13.0	0.0	13.0	0.0	13.0
Seasonal wetland	19.5	16.0	35.5	2.0 <sup>c</sup>	37.5
Grassland	258.7	234.0 <sup>d</sup>	492.7	4.0 <sup>c</sup>	496.7
Agriculture	0.0	0.0	0.0	1,314.0 <sup>e</sup>	1,314.0
Developed areas	283.6	0.0	283.6	0.0	283.6
<b>Total</b>	<b>666.9</b>	<b>282.0</b>	<b>948.9</b>	<b>1,358.0</b>	<b>2,306.9</b>

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<sup>a</sup> Includes 21.7 acres of offsite habitat contiguous with 66.3 acres of onsite habitat.

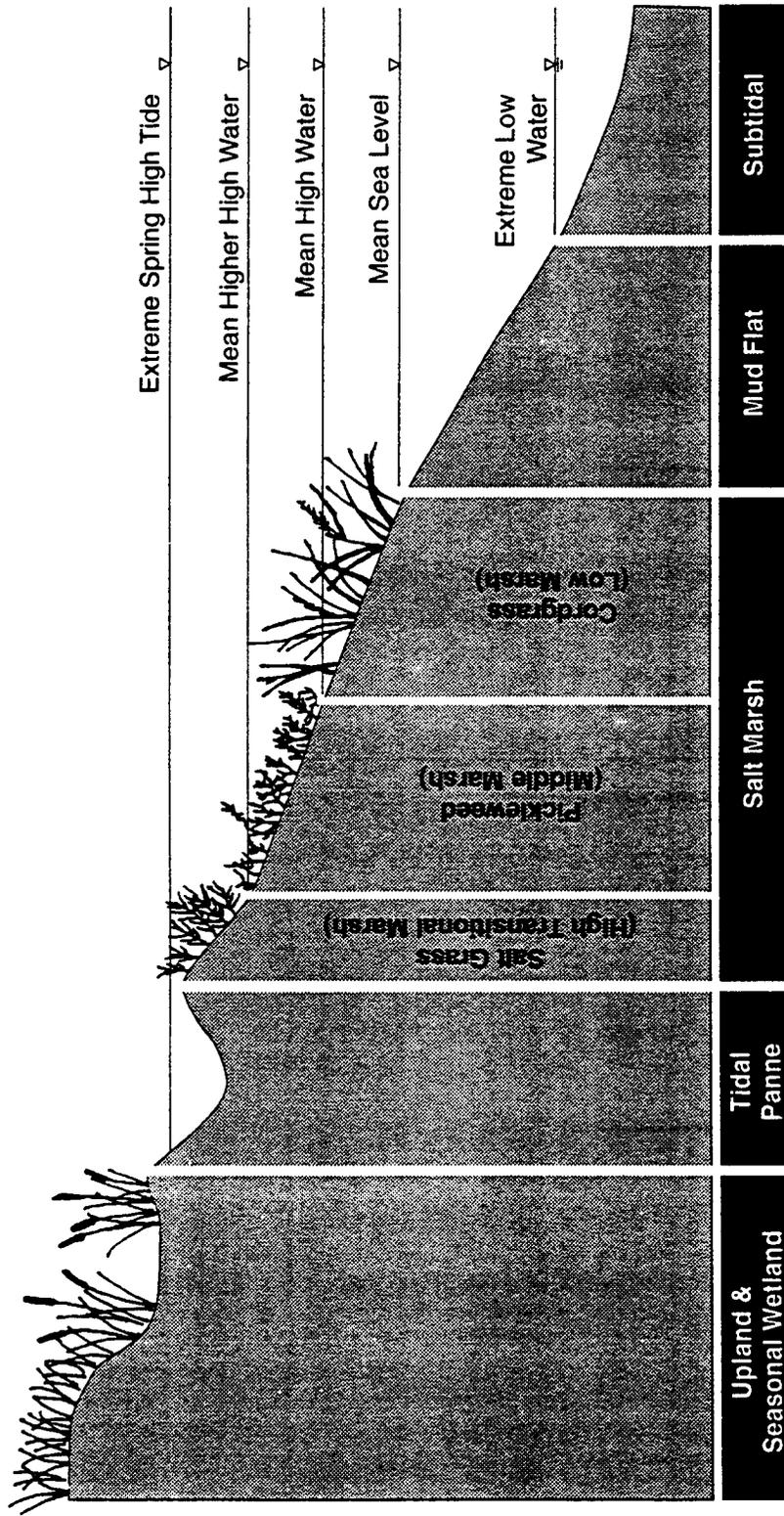
<sup>b</sup> Habitat area is offsite but contiguous with the SLC parcel.

<sup>c</sup> Includes some small developed areas such as outbuildings and antennas.

<sup>d</sup> Estimated from Environmental Science Associates 1993. Includes some small developed areas such as outbuildings and antennas.

<sup>e</sup> Includes small stands of eucalyptus.

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Source: Woodward-Clyde 1998.



Jones & Stokes Associates, Inc.

**Figure 8-2**  
**Schematic of Habitats by Tide Levels**

and, following its expiration, was reverified (U.S. Army Corps of Engineers 1996a). Since the initial delineation, a 12.4-acre jurisdictional seasonal wetland was constructed on the site as mitigation for wetlands affected by the Corps' Landfill 26 closure project (Figure 8-1). In addition, approximately 13 acres of brackish open water wetland was created by removal of material for the Landfill 26 closure project; because the Landfill 26 closure project is ongoing, this wetland is not considered jurisdictional by the Corps.

Wetland delineations of potential jurisdictional wetlands have been completed for the SLC parcel (U.S. Army Corps of Engineers 1998) and BMKV parcel (LSA Associates 1997) but have not yet been verified by the Corps.

**Coastal Salt Marsh (Tidal).** Coastal salt marsh under tidal influence is located between the levee at the eastern end of the project area and the open water of San Pablo Bay. This habitat can be divided into three distinct zones based on the frequency and duration of tidal inundation (Figure 8-2):

- ◆ Low marsh occupies the elevations between mean tide level and mean high water and, as such, is inundated daily. In the project area, low marsh is adjacent to the open waters of San Pablo Bay and is dominated by California cordgrass.
- ◆ Middle marsh habitat occupies the elevations between mean high water and mean higher high water and is dominated by common pickleweed. Middle marsh is predominant outboard of the perimeter levee and is inundated frequently throughout each month, although for shorter periods than is low marsh.
- ◆ High transitional marsh habitat occupies the elevations between mean higher high water and the highest tide level; this habitat is inundated infrequently and for short periods. A narrow strip along the bayside of the levee supports high marsh and supports plant species that are tolerant of saline conditions but not adapted to frequent, long-term inundation, including saltgrass, alkali heath, fat-hen saltplant, and gumplant.

Tidal pannes and marsh ponds are features that are sometimes associated with coastal salt marshes. Tidal pannes are depressional basins that receive freshwater runoff from uplands and saltwater inflow during spring high tides. Pannes generally pond shallow water (less than 6 inches) and, because they often have extremely high salt concentrations, typically are devoid of vegetation. Tidal marsh ponds are similar to pannes, but they do not receive freshwater runoff and, because they are located in the interior of marshes on drainage divides, they are more frequently inundated by tides.

The tidal salt marsh community provides food, cover, and breeding habitat for many wetland-dependent wildlife species. The dense vegetation and large invertebrate populations typically associated with salt marshes provide ideal nesting and foraging conditions for a variety of bird species, including rails, egrets, herons, waterfowl, and shorebirds. In addition to being important habitat for wetland-associated wildlife, the salt marsh community is also a crucial component of the San Pablo Bay ecosystem, providing nutrients and organic matter to the mudflats and open water of the bay. These, in turn, are important habitats for a variety of waterfowl, shorebirds, and other water birds. Wildlife

species observed in the HAAF parcel during field surveys conducted in 1994 include double-crested cormorant, great blue heron, great egret, American coot, killdeer, northern harrier, and San Pablo song sparrow. Other species expected to use tidal salt marsh include the raccoon, mallard, sora, Virginia rail, and willet.

**Coastal Salt Marsh (Nontidal).** Small areas of coastal salt marsh vegetation that are not inundated by tides are located along the interior slopes and base of levees along Novato Creek and San Pablo Bay in the BMKV parcel. Dominant species include pickleweed, saltgrass, brass buttons, ryegrass, and coyote brush. These habitat areas may provide important refugia for wildlife associated with tidal salt marsh during periods of extreme high tides (Environmental Science Associates 1993).

**Brackish Marsh.** Brackish marsh occurs along portions of the perimeter drainage ditch in the HAAF parcel and along drainage ditches and the margins of borrow pits in the BMKV parcel.

Brackish marsh vegetation associated with borrow pits in the BMKV parcel is dominated by saltgrass and pickleweed along pond margins that have open water or exposed mud at the lowest elevations. Portions of the pits are seasonally inundated, and deep areas pond water year round. Open water in the ponds is used by water birds during migration and provides foraging areas for resident waterfowl (Environmental Science Associates 1993).

Dominant emergent wetland plants along drainage ditches are alkali bulrush and cattail. Because marsh vegetation associated with ditches occurs in narrow linear bands, these habitat areas typically support a lower diversity of wildlife than do larger, more contiguous units of brackish marsh. Drainage ditch banks and channels also provide foraging habitat and cover for some species, such as herons, egrets, and dabbling ducks, and movement corridors for striped skunks, raccoons, and other species. Common species observed using the HAAF perimeter ditch include the threespine stickleback, mosquito fish, and red-winged blackbird.

**Brackish Open Water Habitat.** Approximately 13 acres of brackish open water habitat was created by excavation of the Landfill 26 cap borrow pit in the HAAF parcel. Water depth in the pit averages about 4 feet and pit margins support relatively little vegetation. The pit pond provides relatively low-quality wildlife habitat because water depth is marginal for the establishment of emergent vegetation, which provides cover and foraging areas for many wetland-associated species. The pit pond, however, provides suitable resting habitat for waterfowl and other water birds.

**Seasonal Wetland.** Areas of seasonal wetland are present in all three areas. The HAAF parcel includes a 12.4-acre seasonal wetland created as mitigation for the Landfill 26 closure project. Plant species that may dominate in seasonal wetland habitat are saltgrass, alkali heath, salt marsh bulrush, fat-hen saltplant, western goldenrod, sheep sorrel, six-weeks fescue, tall fescue, sedge, rush, and creeping wildrye (Environmental Science Associates 1993).

Seasonal wetlands in all three areas potentially provide high-tide refugia for associated species that use tidal marshes; seasonal foraging and resting habitat for migratory shorebirds, waterfowl, and other water birds; and foraging habitat for raptors, herons, egrets, red-winged blackbirds, raccoons, striped skunks, and aquatic garter snakes (Environmental Science Associates 1993).

Seasonal wetlands in the HAAF parcel are considered low-quality habitat for wildlife, however, because they occur as small, scattered areas, pond water for only a short duration, and provide little cover for wildlife. Consequently, these habitat areas do not have sufficient continuous acreage to meet the breeding and foraging habitat needs of many wetland-dependent wildlife species.

## **Grassland Communities**

Two types of grassland communities, fescue grassland and annual grassland, are present in the project area, although annual grassland is more widespread in the HAAF and SLC parcels.

Annual grassland vegetation in the project site is ruderal (i.e., grows in disturbed areas) and is dominated by weedy non-native annual grasses and forbs, such as ripgut brome, wild oats, Mediterranean barley, perennial ryegrass, yellow star-thistle, curly dock, bristly ox-tongue, and black mustard. Fescue grassland is found mostly in low areas around the southeastern and northwestern margins of the airfield in the HAAF parcel. Vegetation in the fescue grassland is dominated by tall fescue, a non-native, perennial bunchgrass, in association with annual grassland species. Scattered shrubs and non-native trees, such as coyote brush, blackberry, and eucalyptus, are also present in some grassland areas (Environmental Science Associates 1993).

Annual grassland provides important habitat for various wildlife species. The grassland in the HAAF parcel is considered only moderate-quality wildlife habitat because the area is fragmented by the runway and service roads. Representative wildlife species observed using grasslands at the project site are the gopher snake, western fence lizard, turkey vulture, red-tailed hawk, American kestrel, California quail, ring-necked pheasant, savannah sparrow, western meadowlark, Brewer's blackbird, California vole, black-tailed hare, desert cottontail, black-tailed deer, coyote, striped skunk, and raccoon (Environmental Science Associates 1993).

## **Agriculture**

Most of the BMKV parcel comprises agricultural fields that are planted and harvested annually. Approximately 75% of these lands are managed for oat hay production. Following the harvest, fields remain fallow until the following planting season. When

fallow, the fields typically support non-native invasive plants such as star thistle (Environmental Science Associates 1993).

Cultivated fields, particularly when fallow, provide habitat values similar to grasslands and provide habitat for raptors, song birds, and small mammals. During winter, some fields become saturated or seasonally flooded with runoff from precipitation. Flooded fields provide foraging and resting habitat for a wide diversity of wintering and migrant shorebirds, waterfowl, and other water birds during winter.

## **Developed Areas**

Developed areas associated with the HAAF and SLC parcels include hangars, buildings, drainage pump stations, utility infrastructure, antenna installations, aboveground fuel tanks and fuel lines, and paved runway and revetment areas. Developed areas support a low diversity of wildlife compared to vegetated habitats. Species commonly associated with developed areas include the barn swallow, northern mockingbird, American crow, and European starling.

## **Special-Status Species**

Special-status species are plants and animals that are legally protected under the state and federal Endangered Species Acts or other regulations, and species that are considered sufficiently rare by the scientific community to qualify for such listing. Special-status plants and animals are species in the following categories:

- ◆ species listed or proposed for listing as threatened or endangered under the federal Endangered Species Act (50 CFR 17.12 [listed plants], 50 CFR 17.11 [listed animals], and various notices in the Federal Register [FR] [proposed species]);
- ◆ species that are candidates for possible future listing as threatened or endangered under the federal Endangered Species Act (61 FR 7596-7613, February 28, 1996);
- ◆ species listed or candidates for listing by the State of California as threatened or endangered under the state Endangered Species Act (14 California Code of Regulations [CCR] 670.5);
- ◆ species that meet the definitions of rare, threatened or endangered under CEQA (State CEQA Guidelines, Section 15380);
- ◆ plants listed as rare or endangered under the California Native Plant Protection Act (California Fish and Game Code, Section 1900 et seq.);

- ◆ plants considered by the California Native Plant Society (CNPS) to be rare, threatened, or endangered in California (Lists 1B and 2 in Skinner and Pavlik 1994);
- ◆ plants listed by CNPS as plants about which more information is needed to determine their status and plants of limited distribution (Lists 3 and 4 in Skinner and Pavlik 1994), which may be included as special-status species on the basis of local significance or recent biological information;
- ◆ animal species of special concern to DFG (Remsen 1978 [birds], Williams 1986 [mammals], Jennings and Hayes 1994 [amphibians and reptiles], and Moyle et al. 1995 [fish]); and
- ◆ animals fully protected in California (California Fish and Game Code, Section 3511 [birds], 4700 [mammals], and 5050 [reptiles and amphibians]).

Special-status plant and animal species that occur or have potential to occur in or near the project site and their likely status in these areas are presented in Appendix D.

## **Plants**

Fourteen special-status plant species have potential to occur in or near the project areas (Appendix D); however, they are not present in the HAAF and BMKV parcels and are unlikely to be present in the SLC parcel. No special-status plant species have previously been reported from any of the project areas (Natural Diversity Data Base 1997).

Potentially suitable habitat is present for only three of those species: soft bird's-beak, Point Reyes bird's-beak, and Marin knotweed (Environmental Science Associates 1993). Potential habitat for these species is associated with the transitional zone at the upper margins of coastal salt marshes. These species were not found during rare plant surveys conducted in the HAAF parcel in 1993 or during surveys conducted in 1980, 1985, 1988, and 1991 in the BMKV parcel (Environmental Science Associates 1993). Special-status plant surveys have not been conducted in the SLC parcel; however, special-status plants are assumed not to be present because none have been located in similar habitats in adjoining areas. Therefore, this analysis assumes that no special-status plant species are present in the project area or will be affected by the project.

## **Animals**

A total of 42 special-status animal species have potential to occur in or near the project site (Appendix D). Fifteen of these species are unlikely to use the project site because suitable habitat is not present, available habitat is only marginally suitable, or the project site is outside of the species' known range. An additional 15 species of fish, birds, and bats would likely make only incidental use of the project site during migration or when foraging. Twelve special-status fish and wildlife species are known to occur or are

assumed to use suitable habitat within diked portions of the project sites or in marshes and aquatic habitats bayside of the perimeter levees:

- ◆ longfin smelt,
- ◆ Central Valley steelhead,
- ◆ chinook salmon,
- ◆ double-crested cormorant,
- ◆ California brown pelican,
- ◆ California clapper rail,
- ◆ California black rail,
- ◆ northern harrier,
- ◆ burrowing owl,
- ◆ saltmarsh common yellowthroat,
- ◆ San Pablo song sparrow, and
- ◆ salt marsh harvest mouse.

## **Environmental Consequences and Mitigation Measures**

This section describes methods used to analyze potential impacts of the project alternatives compared to Alternative 1: No Action, potential impacts and impact mechanisms of each project alternative, and recommended mitigation measures to reduce significant impacts to a less-than-significant level.

### **Approach and Methodology**

#### **Analytical Methods**

Potential impacts on aquatic, wetland, and grassland habitats were evaluated by comparing the quantity and quality of each type of habitat predicted to develop over time under the project alternatives with habitat conditions under Alternative 1: No-Action. Fish and wildlife species that occur or have potential to occur at the project site were presumed to be indirectly affected by implementation of an alternative if the quantity or quality of habitats with which they are typically associated would be affected. Direct impacts on individual species were assessed qualitatively based on the likely sensitivity or susceptibility of the species to disruption as a result of activities that may be associated with implementation of an alternative (e.g., noise associated with equipment operation).

A major assumption used in this analysis is that conditions predicted to result with implementation of project alternatives will actually develop within 50 years of project implementation. Predictions of future conditions are largely based on predicted rates of sediment accumulation, subsidence of dredged and other fill material, and colonization of plants, as well as predictions of the effects of wave action on plant colonization. The actual rate at which nontidal and tidal wetland habitats will evolve and their distribution

on the project site, however, is somewhat speculative because of uncertainties regarding the actual function and interaction of these parameters in tidal systems. Other assumptions used to conduct this analysis include the following:

- ◆ Restored habitats and supporting hydrology will have stabilized by 50 years after project implementation.
- ◆ All potential sources of surface and subsurface hazardous materials on the project sites will be removed or isolated before the selected project alternative is implemented.
- ◆ All dredged material and other fill material from offsite sources used for project construction will be free of potentially hazardous materials.

### **Impact Mechanisms**

The following types of activities associated with implementation of the project alternatives could result in loss of or disturbance to aquatic, wetland, and grassland habitats and associated species:

- ◆ operating equipment and other construction activity, including constructing internal and perimeter levees, grading, and excavating channels and levee breaches;
- ◆ operating a two hydraulic off-loaders and placing the dredged material pipeline across a portion of San Pablo Bay and in tidal coastal salt marsh;
- ◆ placing dredged material for restoration of wetland and upland habitat areas (under Alternatives 3 and 5 and the BMKV Scenario);
- ◆ reintroducing tidal flow to currently nontidal lands;
- ◆ installing drainage and other water control infrastructure (under Alternatives 2 and 4); and
- ◆ performing management and maintenance activities necessary to maintain target habitats (e.g., activities associated with control of noxious weeds), maintain operation and integrity of infrastructure (e.g., water drainage and control structures), and control mosquito populations.

## Thresholds of Significance

A project alternative was considered to have a significant impact on biological resources if it would:

- ◆ decrease the acreage or quality of intertidal and subtidal aquatic habitats;
- ◆ decrease the acreage or quality of tidal or nontidal wetlands;
- ◆ substantially decrease the acreage or quality of waterfowl breeding or wintering habitat;
- ◆ substantially decrease the acreage or quality of migrant and wintering shorebird habitat; or
- ◆ result in the permanent loss of occupied special-status species habitat or the direct mortality of individuals of special-status species.

An alternative was considered to have a beneficial impact if it would result in a substantial increase in the quantity or quality of subtidal and intertidal aquatic, wetland, and grassland communities or of habitat for wintering waterfowl, migrant and wintering shorebirds, or special-status species.

## Impacts and Mitigation Measures of Alternative I: No Action

Under Alternative 1, no wetland restoration would occur and the HAAF and SLC parcels would remain in caretaker status. The Army would continue to maintain existing facilities, flood control operations, and security systems in the HAAF parcel. The SLC would continue with its current management and operation of the SLC project site.

### Impact 8.1: Potential Improvement in the Quality of Grasslands

Under Alternative 1, activities on the HAAF parcel associated with closure that have affected the composition and structure of grasslands would be completed. Consequently, grassland vegetation would be allowed to mature, increasing forage production (by allowing plants to mature and produce seeds). Increasing the density and height of vegetation would improve the quality of cover for some wildlife species. Therefore, this impact is considered beneficial.

## **Impacts and Mitigation Measures Common to Alternatives 2, 3, 4, and 5**

Because the extent of impacts on biological resources would differ under each alternative, no common impacts are described in this chapter.

## **Impacts and Mitigation Measures Unique to Alternative 2**

Figures 8-3 through 8-5 illustrate the predicted development and distribution of restored habitats at year 0 (i.e., completion of initial construction), year 10, and year 50 following implementation of Alternative 2. Table 8-2 presents a comparison between the acreages of habitats estimated to be restored under Alternative 2 and other alternatives at year 50. Table 8-3 presents the expected net change in habitat acreages under Alternative 2.

### **Impact 8.2: Increase in Subtidal Aquatic Habitat for Resident and Anadromous Fish**

Subtidal aquatic habitat is expected to increase under Alternative 2. As sediment deposition occurs, the open water habitat created initially by breaching the levees would decrease. Stable, vegetated channels would develop, and the habitat value of open water would increase as these channels become deeper and wider. These channels could be used as rearing habitat by longfin smelt and other estuarine and marine fish species. The channels could also provide habitat for phytoplankton, zooplankton, and benthic invertebrates, which provide important food sources for fish. Juvenile chinook salmon and steelhead may temporarily rear in the slough channels during their seaward migration. The increase in aquatic habitat would result in a beneficial impact on resident and anadromous fish.

### **Impact 8.3: Short-Term Loss of or Disturbance to and Long-Term Increase in Intertidal Mudflats**

A small area of intertidal mudflats may be lost or disturbed near the bayside terminus of the excavated subtidal channel as a result of channel scour from tidal flow through the channel. The loss of intertidal mudflat habitat resulting from scour would be substantially offset, however, by intertidal mudflat habitat that would develop along the channel margins following excavation and along the margins of levees following introduction of tidal flows to the restoration site. Intertidal mudflats would develop between mean sea level and extreme low water (Figure 8-2). As sediments are deposited and the site develops, intertidal mudflats would be present in varying amounts. When the wetlands are fully functioning at year 50, intertidal mudflats would be limited to the slough channels and along the margins of subtidal channels. The short-term loss of intertidal mudflats is considered less than significant because only a small area would be disturbed and this would be rapidly replaced. Alternative 2 would result in a long-term beneficial impact on intertidal mudflats as a result of increased acreage.

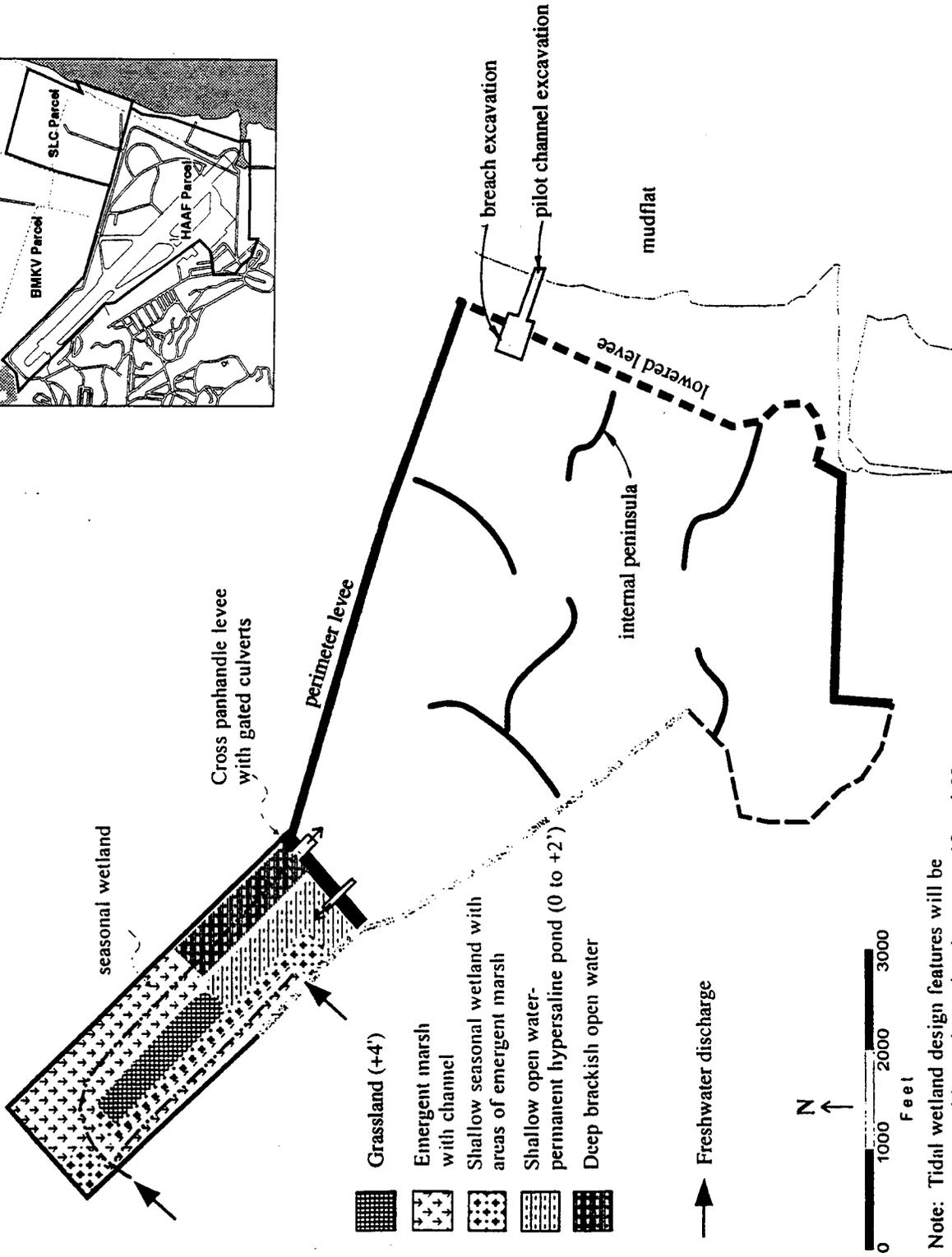
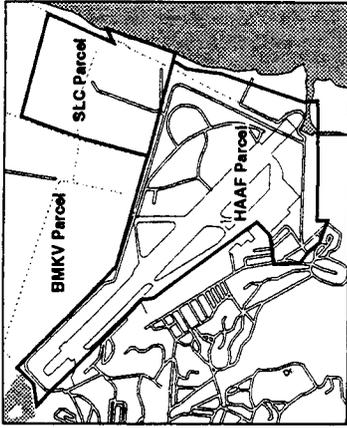
#### **Impact 8.4: Loss of Tidal Coastal Salt Marsh**

Excavation of the 800-foot-long subtidal channel through the tidal marsh would result in the direct loss of approximately 3 acres of high, middle, and low tidal coastal salt marsh. Tidal marsh vegetation, however, is expected to gradually colonize mudflats between the elevations of extreme spring high tide and mean sea level. Sites at these elevations could be colonized by tidal marsh vegetation following introduction of tidal flows, including portions of the lowered bayward levee, margins of the internal peninsulas, and perimeter levees. In the early years of the project, vegetation would most likely establish in locations sheltered from waves. The acreage suitable for establishing tidal coastal salt marsh (the zone between extreme high tide and mean sea level) is expected to increase as a result of sediment deposition. In addition, as the site aggrades and the extent of vegetated area increases, the effects of wave action on the ability of vegetation to establish will reduce because established vegetation will attenuate wave energy across the site.

The loss of 3 acres of tidal coastal salt marsh habitat is expected to be offset by coastal salt marsh habitat developing on the site at a 2:1 in-kind replacement ratio within 10 years following project implementation. At maturity, an estimated 400 acres of tidal coastal salt marsh are expected to be restored on the site (Table 8-3). This represents approximately 133 acres of coastal salt marsh habitat restored for every acre of habitat affected by the project. If coastal salt marsh habitat develops as designed, this impact would be beneficial; however, because of uncertainties regarding the rate of sedimentation and the associated rate of establishment native salt marsh vegetation, marsh habitat of sufficient quality and quantity may not establish rapidly enough to offset losses that occurred during construction of the channel. Therefore, this impact is considered significant. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measure 8.4.

**Mitigation Measure 8.4: Monitor Site Development and Implement Actions to Increase the Rate of Marsh Development if Required.** The Coastal Conservancy, Corps, or successors in interest shall develop and implement a 15-year monitoring program to measure the rate of coastal salt marsh establishment and the quantity and quality of established coastal salt marsh. Restored coastal salt marsh will be monitored annually for the first 5 years and in years 10 and 15 following project implementation. The monitoring program will be designed to determine if coastal tidal marsh is developing and its primary supporting physical processes (i.e., tidal exchange and sedimentation) are occurring at a rate estimated during the first 15 years of project implementation. Major elements of the monitoring program will include the following:

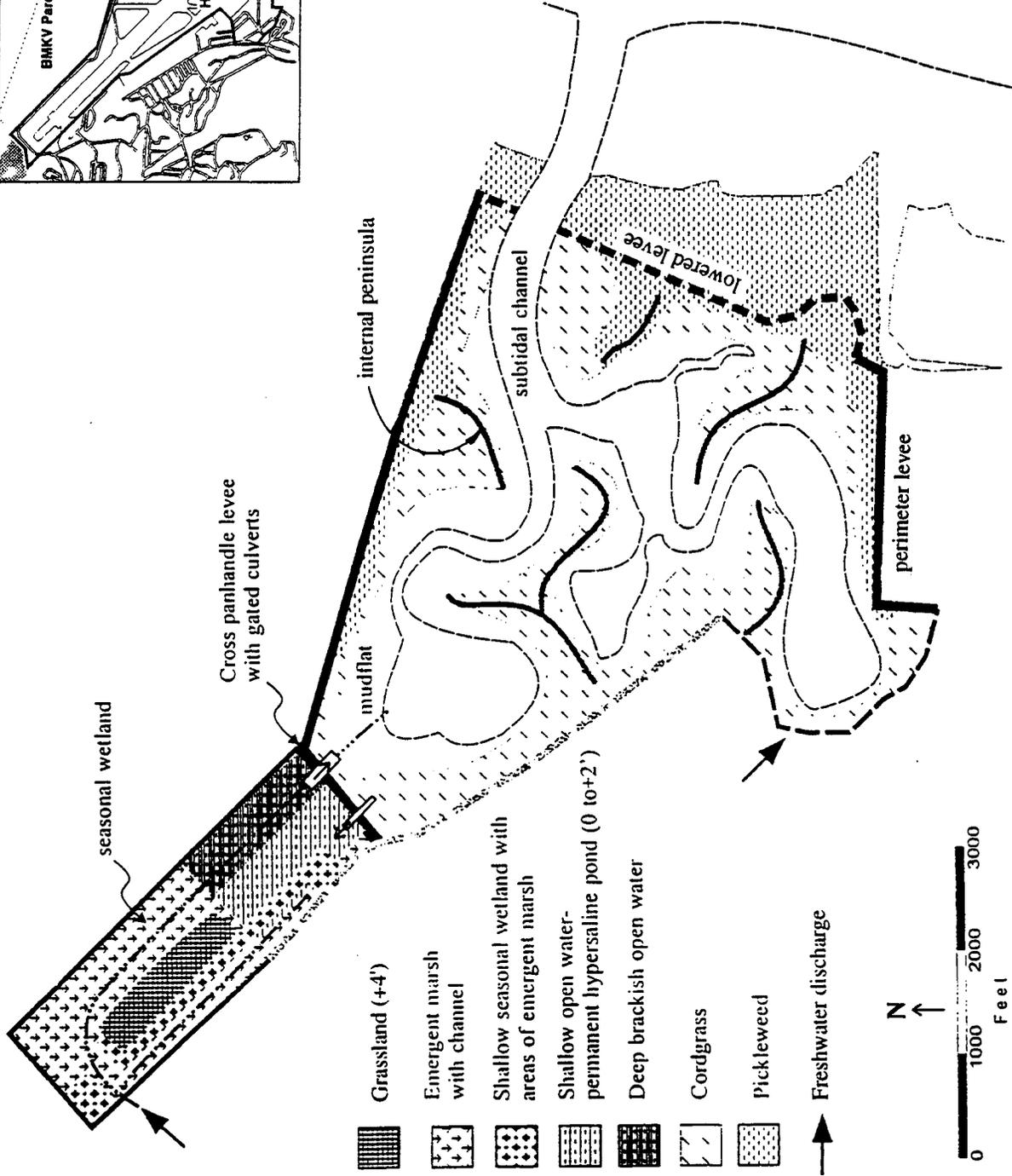
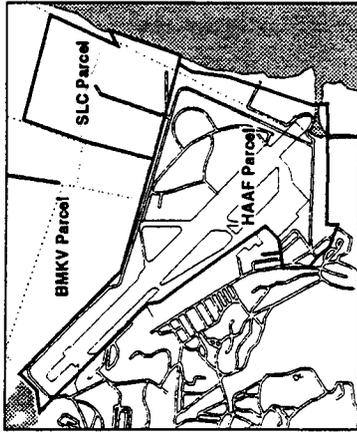
- ◆ measure sedimentation rates and distribution of sedimentation,
- ◆ measure the volume and velocity of tidal exchange,
- ◆ measure the areal extent and locations of established or colonizing salt marsh vegetation,



Note: Tidal wetland design features will be comparable to alternative A at years 10 and 50

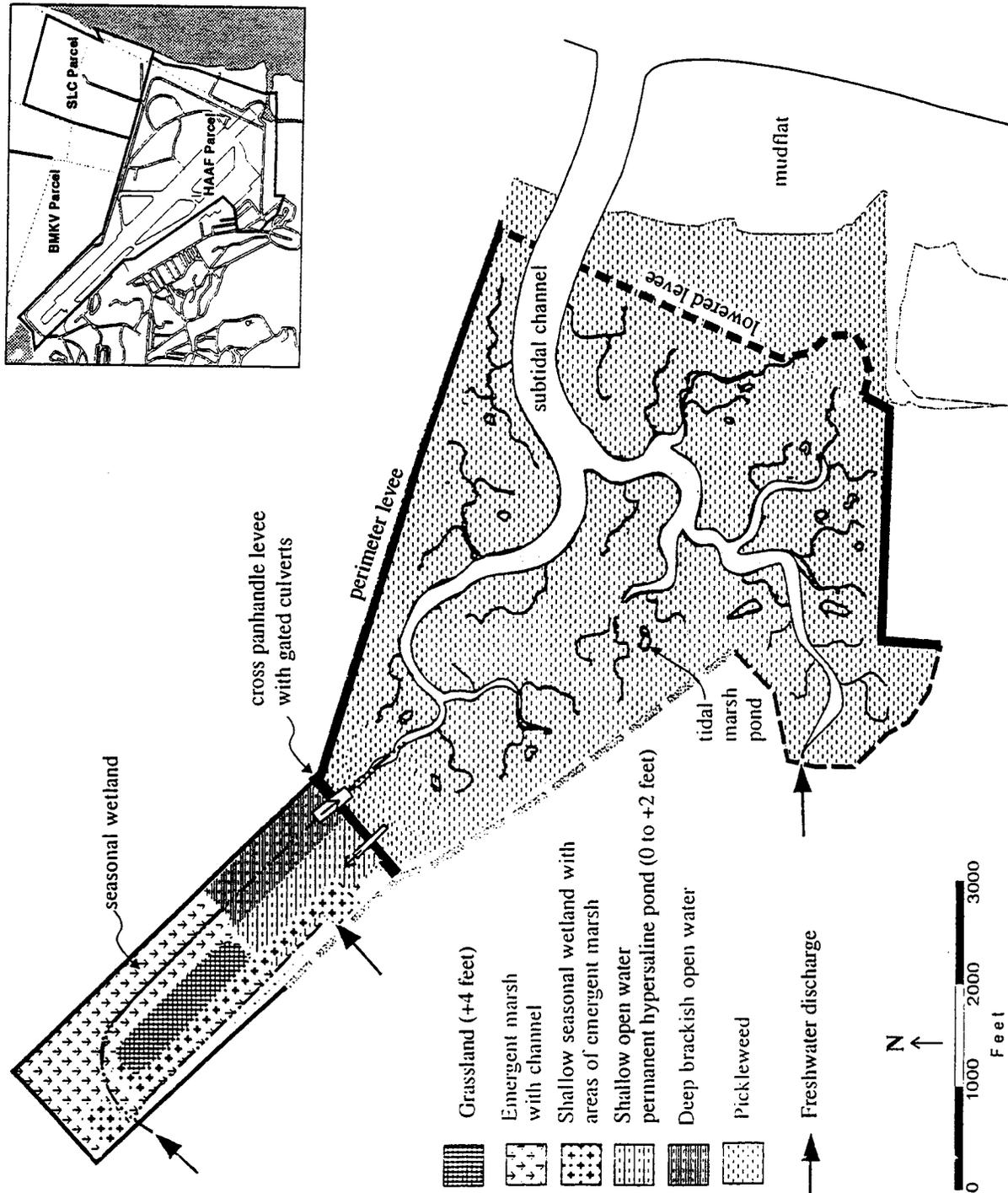
**Figure 8-3**  
**Development and Distribution of Restored Habitat under**  
**Alternative 2 at Year 0**





**Figure 8-4**  
**Development and Distribution of Restored Habitat under**  
**Alternative 2 at Year 10**





**Figure 8-5**  
**Development and Distribution of Restored Habitat under**  
**Alternative 2 at Year 50**

**Table 8-2.**  
**Estimated Acreage of Each Habitat Type under Alternative I: No Action**  
**and Alternatives 2-5 at Year 50 after Project Implementation**

Habitat Type	HAAF Parcel Only			HAAF and SLC Parcels		
	Alternative I: No Action	Alternative 2 <sup>a</sup>	Alternative 3 <sup>a</sup>	Alternative I: No Action	Alternative 4 <sup>a</sup>	Alternative 5 <sup>a</sup>
Subtidal channel/open water	0	26	26	0	44	44
Intertidal channel/mudflat	0	14	14	0	22	22
Coastal salt marsh	88	480	485	120	698	690
Tidal pannes	0	0	33	0	0	41
Tidal ponds	0	3	3	0	4	4
Nontidal wetlands						
Seasonal wetlands/ponds	20	13	62	36	13	62
Perennial emergent marsh	4	65	2	4	65	2
Perennial hypersaline pond	0	13	0	0	13	0
Perennial brackish pond	13	17	0	13	17	0
Grassland	259	36	41	493	74	85
Developed area	284	0	0	284	0	0

<sup>a</sup> Acreages of restored habitats were derived or estimated from Woodward-Clyde 1998.

Note: The alternatives are defined as follows:

- ◆ Alternative 2: Restoration of wetlands in the HAAF parcel through natural sedimentation
- ◆ Alternative 3: Restoration of wetlands in the HAAF parcel using dredged material
- ◆ Alternative 4: Restoration of wetlands in the HAAF and SLC parcels through natural sedimentation
- ◆ Alternative 5: Restoration of wetlands in the HAAF and SLC parcels using dredged material

**Table 8-3.  
Estimated Net Change in Habitat Acreage Compared to Alternative 1:  
No Action at 50 Years after Project Implementation**

Habitat Type	HAAF Parcel Only				HAAF and SLC Parcels			
	Alternative 1: No Action		Alternative 3		Alternative 4		Alternative 5	
	Alternative 1: No Action	Alternative 2	Alternative 3	Alternative 4	Alternative 4	Alternative 5	Alternative 5	
Subtidal channel/open water	0	+26	+26	+44	+44	+44	+44	
Intertidal channel/mudflat	0	+14	+14	+22	+22	+22	+22	
Coastal salt marsh	88	+392	+397	+578	+578	+578	+578	
Tidal pannes	0	0	+33	0	0	+41	+41	
Tidal ponds	0	+3	+3	+4	+4	+4	+4	
Nontidal wetlands								
Seasonal wetlands/ponds	20	-7	+42	-23	-23	+26	+26	
Perennial emergent marsh	4	+61	-2	+61	+61	-2	-2	
Perennial hypersaline pond	0	+13	0	+13	+13	0	0	
Perennial brackish pond	13	+4	-13	+4	+4	-13	-13	
Grassland	259	-223	-218	-419	-419	-408	-408	
Developed area	284	-284	-284	-284	-284	-284	-284	

Note: The alternatives are defined as follows:

- ◆ Alternative 2: Restoration of wetlands in the HAAF parcel through natural sedimentation
- ◆ Alternative 3: Restoration of wetlands in the HAAF parcel using dredged material
- ◆ Alternative 4: Restoration of wetlands in the HAAF and SLC parcels through natural sedimentation
- ◆ Alternative 5: Restoration of wetlands in the HAAF and SLC parcels using dredged material

- ◆ measure composition and density of established and colonizing plant species,
- ◆ compare predicted and measured site development and function,
- ◆ analyze monitoring data to identify possible reasons for differences between observed and predicted conditions, and
- ◆ recommend remedial actions that could be implemented if the restoration is not proceeding as designed.

Monitoring reports will be submitted by the Coastal Conservancy or successors in interest to the Corps, DFG, and USFWS by November 1 of each monitoring year.

At the end of the initial 5-year monitoring period, if the development rate of the coastal salt marsh and the habitat quality of establishing coastal salt marsh do not appear sufficient to restore 6 acres of contiguous, in-kind habitat within 10 years of project implementation, the Coastal Conservancy or successors in interest will review the project with representatives of the Corps, DFG, and USFWS to determine if additional actions or project modifications are necessary to ensure that the functions and values of the affected coastal salt marsh habitat will be replaced. Similar reviews of marsh development may be conducted following completion of monitoring in years 10 and 15 if it appears that additional actions or project modifications are necessary to meet restoration goals.

### **Impact 8.5: Loss of Approximately 1.2 Acres of Brackish Marsh**

Establishing tidal exchange at the project site would result in the direct loss of approximately 1.2 acres of brackish marsh associated with the perimeter drainage ditch. This loss would be offset by the planned restoration of 98.5 acres of seasonal wetland, seasonal pond, brackish marsh, and upland habitats behind the cross panhandle levee (Table 8-3). With the designed change in site hydrology behind the cross panhandle levee, brackish marsh vegetation is expected to colonize gradually and establish along the margins of the existing 13-acre brackish pond, along constructed and existing drainage channels, and interspersed among surrounding seasonal wetlands and uplands that provide the necessary subsurface and surface hydrology.

The loss of 1.2 acres of brackish marsh habitat is expected to be offset by the development of brackish marsh habitat on the site at a 2:1 in-kind replacement ratio within 5 years of project implementation. Although substantially more than 2.4 acres of brackish marsh habitat is expected to be restored, because of uncertainties regarding the development of subsurface and surface hydrology and the associated quantity of brackish marsh vegetation, brackish marsh of sufficient quality and quantity may not establish rapidly enough to offset project impacts that occurred during construction and inundation of the restoration site. The potential loss of brackish marsh is considered significant. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measure 8.5.

**Mitigation Measure 8.5: Monitor Development of Brackish Marsh Vegetation and Implement Actions to Increase the Area of Brackish Marsh if Required.** The Coastal Conservancy, Corps, or successors in interest shall develop and implement a 5-year monitoring program to measure the establishment rate, quantity, and quality of brackish marsh vegetation. Major elements of the monitoring program will include the following:

- ◆ measure the areal extent and locations of established or colonizing marsh vegetation,
- ◆ measure composition and density of established and colonizing plant species,
- ◆ compare predicted and measured site development and function,
- ◆ analyze monitoring data to identify possible reasons for differences between observed and predicted conditions, and
- ◆ recommend remedial actions that could be implemented if the restoration is not proceeding as designed.

Monitoring reports will be submitted by the Coastal Conservancy or successors in interest to the Corps, DFG, and USFWS by November 1 of each monitoring year.

If the development rate of the brackish marsh and the habitat quality of establishing brackish marsh do not appear sufficient to offset the loss of the 2.4 acres within 5 years of project implementation, the Coastal Conservancy or successors in interest will review the project with representatives of the Corps, DFG, and USFWS to determine if additional actions or project modifications are necessary to ensure that the functions and values of the affected brackish marsh habitat will be replaced.

### **Impact 8.6: Temporary Disturbance of Approximately 2.9 Acres of Brackish Marsh**

Approximately 2.9 acres of brackish marsh associated with a portion of Pacheco Pond could be affected during the construction period. Operation of construction equipment in or immediately adjacent to marsh vegetation and discharge of construction-generated sediments into the marsh could result in the loss or degradation of the 2.9 acres. This potential loss is considered a significant impact. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measure 8.6.

**Mitigation Measure 8.6: Avoid or Minimize Temporary Construction-Related Impacts on Brackish Marsh Associated with Pacheco Pond.** To avoid or minimize potential impacts on brackish marsh vegetation associated with construction activities around Pacheco Pond, the Coastal Conservancy, Corps, or successors in interest shall

ensure that the following measures are implemented, where feasible, immediately before and throughout the construction period in the panhandle portion of the site:

- ◆ Construction fencing will be placed at least 25 feet from the perimeter of marsh vegetation adjacent to Pacheco Pond and the project site to clearly demarcate the limits of construction.
- ◆ Vehicles and other equipment related to construction will not be operated beyond the construction fence.
- ◆ Appropriate barriers will be installed to prevent sediment or runoff from being discharged from the construction site into the marsh.

If ground disturbance to marsh vegetation cannot be avoided, the final design planting plan will include appropriate measures to revegetate disturbed areas, including planting and grading if necessary.

### **Impact 8.7: Loss of Approximately 0.1 Acre of Seasonal Wetlands**

Creating tidal exchange at the project site and constructing the cross panhandle levee would result in the loss of four small areas of seasonal wetland habitat, totaling approximately 0.1 acre. These areas, located east of the cross panhandle levee, are very small and occur as inclusions within highly disturbed non-native annual grassland. Because of their size and location, the wetlands provide few of the functions and values of higher quality seasonal wetlands. The loss of 0.1 acre of seasonal wetlands would be offset if at least 0.1 acre of seasonal wetlands develops (1:1 in-kind or out-of-kind replacement ratio) and is maintained on the site within 5 years following project implementation. Under the proposed action, approximately 98.5 acres of seasonal wetland would be restored behind the cross panhandle levee (Table 8-3). The loss of 0.1 acre of wetlands is considered less than significant because of the relative value of the wetlands and because the loss would be offset by the establishment of 98.5 acres of wetlands elsewhere on the project site.

### **Impact 8.8: Conversion of or Temporary Disturbance to Approximately 19.4 Acres of Seasonal Wetlands**

The restoration project would affect approximately 19.4 acres of existing seasonal wetlands located west of the cross panhandle levee as a result of construction-related disturbances to existing areas of seasonal wetland habitat and conversion of existing seasonal wetlands to other types of wetlands (i.e., hypersaline pond, seasonal saline wetland, or brackish marsh). The existing wetland habitat includes 12.4 acres of seasonal wetland constructed as mitigation for the Landfill 26 closure project.

Construction activities that could temporarily affect the Landfill 26 mitigation wetland and other wetland areas include operation of construction equipment in or immediately

adjacent to wetland vegetation and discharge of construction generated sediments into wetlands. The grade of some existing wetlands (although not the Landfill 26 mitigation wetland) may be altered to achieve design grades or drainage necessary to restore seasonal wetlands or construct upland habitat areas. This alteration of existing grades and site hydrology could result in the conversion of some existing seasonal wetland areas to other types of wetland.

Temporary disturbance to or type conversion of 19.4 acres of existing seasonal wetlands would be offset if at least 19.4 acres of seasonal wetland develops (1:1 in-kind or out-of-kind replacement ratio) and is maintained on the site within 5 years following project implementation. Approximately 98.5 acres of additional seasonal wetland habitat area will be restored west of the cross panhandle levee. This impact is considered beneficial.

### **Impact 8.9: Loss of Grassland**

Constructing project levees, restoring wetlands, and other features of the proposed action would result in the direct loss of approximately 191 acres of grassland habitat. Loss of grasslands would reduce the available habitat area for western meadowlarks, Brewer's blackbirds, and other regionally abundant songbirds.

Under Alternative 2, the loss of grassland habitat would be partially offset because fewer, higher quality grasslands would be established near restored wetlands. These grassland areas would provide nesting cover for waterfowl and other ground-nesting species, and refugia for small mammals, reptiles, and other wildlife. Restored grassland would be seeded with desirable grasses and forbs that would generally provide higher forage and cover values for wildlife than grassland affected by the project. The short-term impact associated with the loss of grassland is considered less than significant because grassland is regionally abundant, and the short-term loss of grassland habitat is expected to have little or no effect on regional populations of grassland-associated wildlife. The long-term impact is considered beneficial because grassland habitat values associated with the project would be greater than existing values.

### **Impact 8.10: Temporary Disturbance to the California Clapper Rail and California Black Rail during Construction**

Noise, vibration, visual, and proximity-related disturbances associated with project construction could adversely affect the California clapper rail and California black rail during the breeding season. Construction disturbances could cause individuals of these species to abandon their nests or reduce the ability of adults to properly care for their eggs, thereby potentially reducing breeding success. Occupied California clapper rail and California black rail nesting areas are located in salt marshes outboard of the perimeter levee. Therefore, this impact is considered significant. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measure 8.10.

**Mitigation Measure 8.10: Avoid Construction Activities Near Occupied California Clapper Rail and California Black Rail Habitat Areas during Their Breeding Periods.** The perimeter levee would serve as a barrier to reduce the magnitude of visual, noise, and other disturbances potentially associated with construction-related activities that occur landward of the levee before the levee is lowered. To further reduce the potential for adverse effects of construction-related disturbance on nesting California clapper rails and California black rails, the Coastal Conservancy, Corps, or successors in interest, to the extent feasible to successfully complete project construction, shall ensure that construction activities do not occur within 100 feet of the landward toe of the perimeter levee during the nesting period of these species (March 15 to July 30).

The Coastal Conservancy, Corps, or successors in interest, to the extent feasible to successfully complete project construction, shall avoid construction activities associated with lowering the perimeter levee and excavating the pilot channel through the outboard salt marsh during the nesting period of these species (March 15 to July 30). If construction of these project features must occur during the nesting period, surveys will be conducted by a qualified biologist using survey methods approved by USFWS and DFG before construction is initiated to locate clapper rail and black rail nest sites within 300 feet of the limits of construction. Survey results will be submitted to USFWS and DFG. If nests are not located within 300 feet of the limits of construction, construction may proceed. If nest sites are located, the Coastal Conservancy, Corps, or successors in interest will consult with USFWS and DFG to determine what, if any, additional mitigation measures may be required to allow construction to proceed (also see Mitigation Measure 8.13).

**Impact 8.II: Temporary Disturbance to the Northern Harrier, Burrowing Owl, Saltmarsh Common Yellowthroat, and San Pablo Song Sparrow during Construction**

Noise, vibration, visual, and proximity-related disturbances associated with project construction could adversely affect the northern harrier, burrowing owl, saltmarsh common yellowthroat, and San Pablo song sparrow during the breeding season. If individuals of these species nest in the project area during the project construction period, construction disturbances could cause individuals of these species to abandon their nests or young; the breeding success of these species could be reduced if disturbances reduce the ability of adults to properly care for their eggs or young. Therefore, this impact is considered significant. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measure 8.11.

**Mitigation Measure 8.II: Conduct Surveys to Locate Northern Harrier, Burrowing Owl, Saltmarsh Common Yellowthroat, and San Pablo Song Sparrow Nest Sites before Construction Is Initiated.** The Coastal Conservancy, Corps, or successors in interest shall conduct surveys to locate northern harrier, burrowing owl, saltmarsh common yellowthroat, and San Pablo song sparrow nest sites in suitable breeding habitats in the spring of each construction year. Surveys will be conducted by a qualified biologist using survey methods approved by DFG. Survey results will be submitted to DFG before construction is initiated. If nests or young of these species are not located, construction

may proceed. If nest sites or young are located, the Coastal Conservancy, Corps, or successors in interest will consult with DFG to determine what mitigation measures could be implemented to avoid or reduce potential disturbance-related impacts on these species (e.g., establishing buffers around active nest sites or sequencing construction activities to avoid activities near nesting habitats during the breeding season).

### **Impact 8.12: Potential for Construction-Related Mortality of Salt Marsh Harvest Mice**

Breaching and lowering the perimeter levee and excavating the tidal channel in the outboard marsh could result in direct mortality of the salt marsh harvest mouse, a federally listed and state-listed endangered species. This impact is considered significant. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measure 8.12.

**Mitigation Measure 8.12: Remove Salt Marsh Harvest Mice from the Immediate Vicinity of Operating Equipment.** The potential for construction-related mortality of salt marsh harvest mice could be reduced or eliminated by erecting a barrier fence 20 feet from the boundaries of construction areas in and adjacent to coastal salt marsh habitat, live-trapping mice that are found in the construction corridor, and releasing captured mice into suitable habitat areas outside of the fenced construction corridor. The Coastal Conservancy, Corps, or successors in interest will consult with USFWS and DFG to evaluate the feasibility of trapping and releasing mice from construction areas and to identify other appropriate methods for avoiding construction-related mortality of salt marsh harvest mice.

### **Impact 8.13: Potential for Construction-Related Mortality of California Clapper Rails and California Black Rails**

Breaching and lowering the perimeter levee and excavating the tidal channel could result in direct mortality of California clapper rails and California black rails. Nests with eggs or young birds could be crushed by construction equipment operating in the outboard tidal marsh. This impact is considered significant because project activities could result in the direct mortality of individuals of the two special-status species. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measure 8.13.

**Mitigation Measure 8.13: Avoid Operation of Equipment in the Outboard Tidal Marsh during the Breeding Period of the California Clapper Rail and California Black Rail.** The Coastal Conservancy, Corps, or successors in interest, to the extent feasible to successfully complete project construction, shall avoid operating construction equipment in the outboard tidal marsh from March 15 to July 31. If construction equipment must operate in the marsh during this period, surveys will be conducted by a qualified biologist using survey methods approved by USFWS and DFG before construction is initiated to locate clapper rail and black rail nest sites or young of these species within 300 feet of the limits of construction. Survey results will be submitted to

USFWS and DFG. If nests or young are not located within 300 feet of the limits of construction, construction may proceed. If nest sites or young are located, the Coastal Conservancy, Corps, or successors in interest will consult with USFWS and DFG to determine what, if any, additional mitigation measures may be required to allow construction to proceed (also see Mitigation Measure 8.10).

#### **Impact 8.14: Potential for Mortality of San Pablo Song Sparrows**

Construction activities in tidal and nontidal marsh habitats and inundation of nontidal wetlands by tidal flow could result in direct mortality of San Pablo song sparrows. Nests with eggs or young birds could be crushed by construction equipment or inundated or toppled by tidal flow. This impact is considered significant because project activities could result in the mortality of individuals of this special-status species. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measure 8.14.

**Mitigation Measure 8.14: Conduct Surveys to Locate San Pablo Song Sparrow Nest Sites before Construction Is Initiated.** The Coastal Conservancy, Corps, or successors in interest shall conduct surveys to locate San Pablo song sparrow nest sites in suitable marsh habitats in the spring of each construction year. Surveys will be conducted by a qualified biologist using survey methods approved by DFG. Survey results will be submitted to DFG before construction is initiated. If active nests are not located, construction may proceed. If nest sites are located, the Coastal Conservancy, Corps, or successors in interest will consult with DFG to determine what mitigation measures could be implemented to avoid or reduce potential mortality of this species (e.g., establishing buffers around active nest sites or sequencing construction activities to avoid potential impacts on the species during the breeding season).

#### **Impact 8.15: Potential for Mortality of Burrowing Owls**

Operating equipment in grasslands west of the perimeter levee and introducing tidal flow could result in direct mortality of burrowing owls. Occupied nesting burrows could be crushed or buried by construction equipment or inundated as a result of tidal flow. This impact is considered significant because it could result in the direct mortality of individuals of this special-status species. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measure 8.15.

**Mitigation Measure 8.15: Conduct Surveys to Locate Burrowing Owl Nest Sites before Construction Is Initiated.** The Coastal Conservancy, Corps, or successors in interest shall conduct surveys to locate burrowing owl nest sites in suitable grassland habitats in the spring of each construction year. Surveys will be conducted by a qualified biologist using survey methods approved by DFG. Survey results will be submitted to DFG before construction is initiated. If active nests are not located, construction may proceed. If nest sites are located, the Coastal Conservancy, Corps, or successors in interest

will consult with DFG to determine what mitigation measures could be implemented to reduce potential mortality of this species (e.g., establishing buffers around active nest sites or sequencing construction activities to avoid potential impacts on the species during the breeding season).

### **Impact 8.16: Potential Disturbance to or Mortality of Special-Status Species resulting from Management and Maintenance Activities**

Management and maintenance activities such as mosquito abatement, water control structure and levee maintenance, and control of noxious weeds, may be required to ensure project success. These activities could result in disturbance to or mortality of special-status species if special-status species occupy restored habitats. This impact, similar to Impacts 8.8 through 8.12, is considered significant. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measure 8.16.

**Mitigation Measure 8.16: Develop and Implement a Restoration Management and Maintenance Program Designed to Minimize Potential Impacts on Special-Status Species.** The Coastal Conservancy, Corps, or successors in interest will develop a restoration management and maintenance program, in coordination with USFWS and DFG, within 1 year after the completion of project construction. Important elements of the program will be scheduling maintenance activities to avoid periods when special-status species are sensitive to disturbance and implementing management practices that have minimal effects on special-status species to the greatest extent feasible.

### **Impact 8.17: Loss of Habitat for California Clapper Rail, California Black Rail, Salt Marsh Harvest Mouse, and Saltmarsh Common Yellowthroat**

The California clapper rail, California black rail, salt marsh harvest mouse, and saltmarsh common yellowthroat are dependent on coastal salt marsh habitats. As described in Impact 8.2, approximately 3 acres of tidal coastal salt marsh would be lost as a result of construction of project features in the tidal marsh. If restoration performs as predicted, suitable habitat for these species could be increased by approximately 400 acres. However, because of uncertainties regarding the development of project marshes, this analysis must assume that the quality, type, and minimum habitat patch size required by these species may not develop (as described under Impact 8.4). Therefore, this impact is considered significant. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measure 8.4.

### **Impact 8.18: Loss of Refugia for the California Clapper Rail, California Black Rail, and Salt Marsh Harvest Mouse**

Lowering portions of the perimeter levee to elevations approximating that of mean higher high water would result in the loss of suitable refugia for the California clapper rail, California black rail, and salt marsh harvest mouse when the outboard marsh is inundated during high tides. Additional refugia would be provided by transitional and upland habitat areas restored at the upper elevations of restored tidal marshes. These habitat areas would be accessible to rails but could be too distant from the outboard marsh to be used by salt marsh harvest mice. Some portions of the lowered perimeter levee, however, would be at higher elevations that would not be inundated by tides and, therefore, would continue to provide flood refugia for mice and rails. Therefore, this impact is considered less than significant and no mitigation is required.

### **Impact 8.19: Loss of Nesting Habitat for the San Pablo Song Sparrow**

Coastal salt marsh in the project area is potential suitable nesting habitat for the San Pablo song sparrow ~~includes brackish marsh and coastal salt marshes, which are present in the project area.~~ As described under ~~Impacts 8.2 and 8.3~~ Impact 8.4, approximately ~~4.2~~ 4.3 acres of ~~brackish marsh and~~ tidal coastal salt marsh would be lost as a result of construction of project features. If restoration performs as predicted, suitable habitat for this species could be increased by more than 400 acres. However, because of uncertainties regarding development of the project marshes, this analysis must assume that the quality, type, and minimum habitat patch size required by this species may not develop (as described under ~~Impacts 8.4 and 8.5~~ Impact 8.4). Therefore, this impact is considered significant. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation ~~Measures 8.4 and 8.5~~ Measure 8.4.

### **Impact 8.20: Loss of Nesting Habitat for the Burrowing Owl**

Construction activities associated with levee and seasonal wetland construction and inundation of grassland habitat by tidal flow would result in the permanent loss of approximately 233 acres of potential burrowing owl nesting habitat. Burrowing owls have nested at the project site in previous years but were not located during wildlife surveys conducted in 1994 (U.S. Army Corps of Engineers 1996a). Because slopes of constructed levees and restored upland habitat areas would provide suitable nesting habitat for this species, this impact is considered less than significant and no mitigation is required.

### **Impact 8.21: Increase in Suitable Quality of Nesting Habitat for the Northern Harrier**

Development of undisturbed grassland, seasonal wetland, and brackish marsh, ~~and tidal marsh~~ vegetation, all of which are expected to become established as a result of project implementation, would substantially increase the area of suitable preferred and

undisturbed nesting habitat for the northern harrier, a state-listed species of special concern. This impact is considered beneficial.

### **Impact 8.22: Increase in Suitable Habitat for the Brown Pelican and Double-Crested Cormorant**

Breaching the perimeter levee and introducing tidal flow to the project site east of the cross panhandle levee would initially create a large body of open water, which would provide suitable resting habitat for the brown pelican and double-crested cormorant. If tidal flows into the marsh are sufficient to entrain substantial numbers of fish and other prey items, open water areas would also provide suitable foraging habitat for these species. The area of suitable habitat for these species would decrease, however, as the project site aggrades with sedimentation and vegetation becomes established. At project maturity, subtidal channels would continue to provide suitable habitat for these species. This impact is considered beneficial.

### **Impact 8.23: Increase in Suitable Nesting Habitat for Resident Waterfowl**

Development of undisturbed grassland, seasonal wetland, brackish marsh, and tidal marsh vegetation, all of which are expected to become established as a result of project implementation, would substantially increase the area of suitable waterfowl nesting habitat. This impact is considered beneficial.

### **Impact 8.24: Increase in Suitable Habitat for Wintering Waterfowl**

Development of grassland, seasonal wetland, brackish marsh, tidal marsh, and pond habitats, all of which are expected to become established as a result of project implementation, would substantially increase the area of suitable foraging and resting habitat for migrating and wintering waterfowl. Because most of the project area would not be accessible for recreation or other public uses, the project area could serve as an important resting area during the waterfowl hunting season. The quality and quantity of suitable foraging and resting habitat would change over time (e.g., the area of open water and mudflat would be reduced as areas of restored tidal marsh aggrade and become vegetated). This impact is considered beneficial.

### **Impact 8.25: Increase in Suitable Habitat for Migratory Shorebirds**

Mudflats and shallow water (less than 6 inches deep) are important foraging and resting habitat areas for shorebirds that migrate through and winter in coastal and central California. Breaching the outboard levee and introducing tidal flow to the project site east of the cross panhandle levee would initially create areas of tidal mudflat around the edges of and along channels in the tidal marsh restoration area. Tidal mudflats are expected to support large numbers of benthic organisms that are prey for shorebirds. As the site

aggrades, but before large portions of the tidal marsh become vegetated, the area of tidal mudflat would increase; as the site continues to mature, tidal mudflats would primarily be limited to slough channels and along the margins of subtidal channels.

Unvegetated shallow water and exposed mud associated with seasonal wetlands and hypersaline ponds that would be restored west of the cross panhandle levee would also provide suitable shorebird foraging habitat. These habitat areas would also provide resting areas during periods of extreme tides that inundate tidal habitats used regularly by these species. This impact is considered beneficial.

### **Impacts and Mitigation Measures Unique to Alternative 3**

Figures 8-6 through 8-8 (depicting the HAAF parcel only) illustrate the predicted development and distribution of restored habitats at years 0, 10, and 50, respectively, following implementation of Alternative 3. Table 8-2 presents a comparison between the predicted quantities of habitats restored under Alternative 3 and other alternatives at year 50. Table 8-3 presents the expected net change in habitat acreages under Alternative 3.

#### **Impact 8.26: Increase in Subtidal Aquatic Habitat for Resident and Anadromous Fish**

This impact is the same as Impact 8.2 described above for Alternative 2, except that, because dredged material would be placed in areas restored to tidal flow, subtidal habitat areas are expected to evolve into intertidal and marsh habitats more rapidly under Alternative 3. This impact is considered beneficial.

#### **Impact 8.27: Short-Term Loss of or Disturbance to and Long-Term Increase in Intertidal Mudflats**

This impact is the same as Impact 8.3 described above for Alternative 2, except that, because dredged material would be placed in areas restored to tidal flow, tidal salt marsh vegetation would establish more rapidly because the site is expected to aggrade to elevations that would sustain vegetation earlier in the process of site development. Consequently, tidal mudflats would evolve to tidal coastal salt marsh sooner following introduction of tidal exchange to the site than under Alternative 2. This impact is considered beneficial.

#### **Impact 8.28: Loss of Tidal Coastal Salt Marsh**

This impact is the same as Impact 8.4 described above for Alternative 2, except that slightly more habitat area would be affected as a result of placement of the dredged material pipeline in the tidal marsh and slightly less habitat area would be restored under

Alternative 3. This impact is considered significant. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measure 8.4.

### **Impact 8.29: Loss of Approximately 1.2 Acres of Brackish Marsh**

This impact is the same as Impact 8.5 described above for Alternative 2, except that approximately 102 acres of seasonal wetlands, seasonal ponds, and upland habitats would be restored. Brackish marsh vegetation is expected to gradually colonize and establish along drainage channels through the wetlands and in seasonal ponds that pond water for a sufficient period to allow establishment of emergent vegetation. Substantially more than 2.4 acres of brackish marsh vegetation are likely to develop on the site.

If brackish marsh develops as designed, this impact would be beneficial; however, because of uncertainties regarding the development and operation of subsurface and surface hydrology and the associated quantity of brackish marsh vegetation, brackish marsh of sufficient quality and quantity may not establish rapidly enough to offset project impacts. Therefore, this impact is considered significant. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measure 8.5.

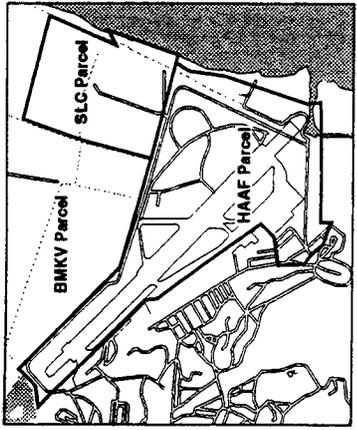
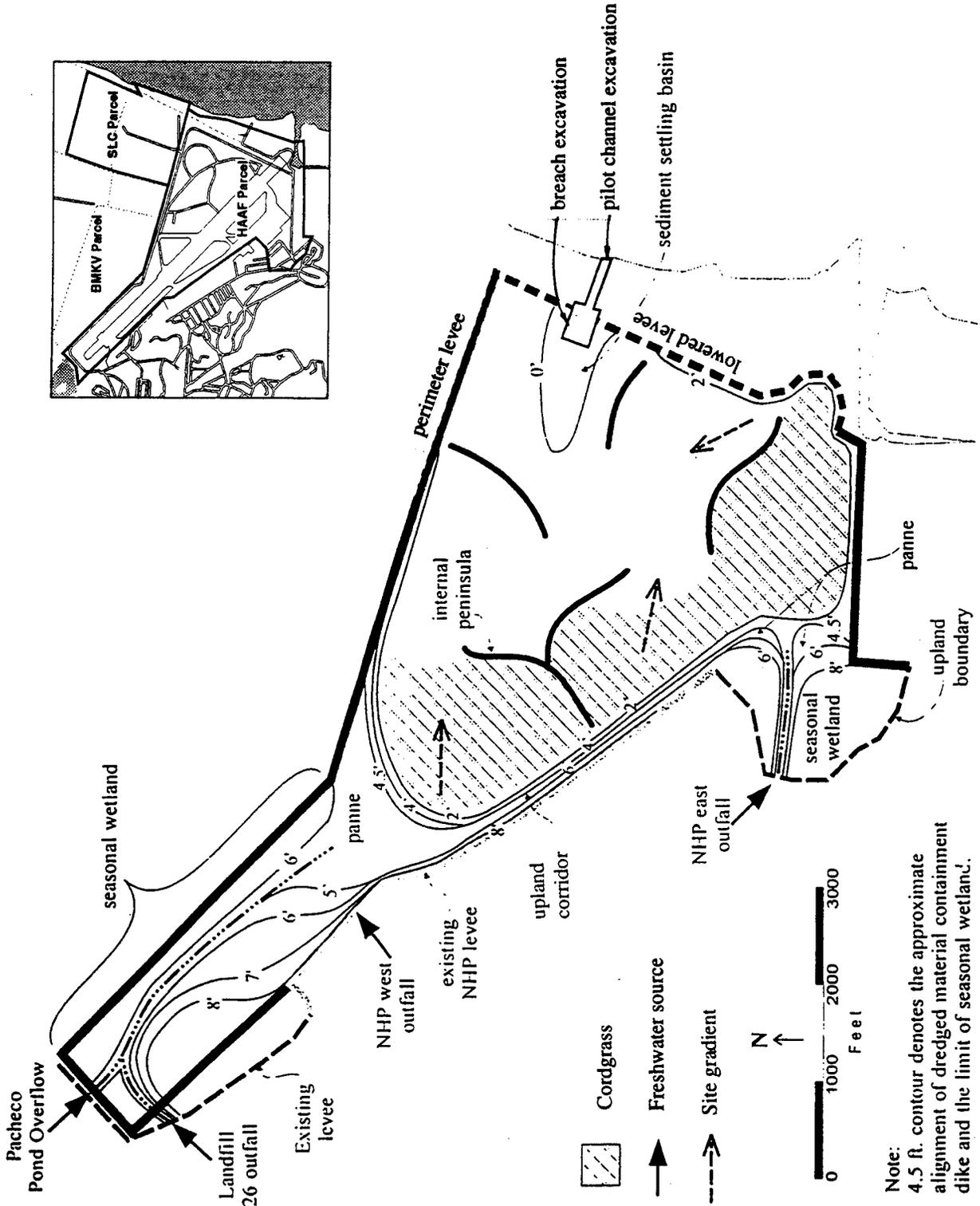
### **Impact 8.30: Temporary Disturbance of Approximately 2.9 Acres of Brackish Marsh**

This impact is the same as Impact 8.6 described above for Alternative 2. This impact is considered significant. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measure 8.6.

### **Impact 8.31: Loss of Approximately 19.5 Acres of Seasonal Wetlands**

Restoration of seasonal and tidal wetlands and uplands would result in the loss of approximately 19.5 acres of existing seasonal wetlands. The existing wetland habitat area includes 12.4 acres of seasonal wetland constructed as mitigation for the Landfill 26 closure project. Restoration would result in direct loss of seasonal wetlands from introduction of tidal flows and placement of dredge material in wetlands.

Loss of 19.5 acres of existing seasonal wetlands would be offset if at least 19.5 acres of seasonal wetland develops (1:1 in-kind or out-of-kind replacement ratio) and is maintained on the site within 5 years following project implementation. Under Alternative 3, approximately 102 acres of additional seasonal wetland habitat area would be restored on the site. This impact is considered beneficial.

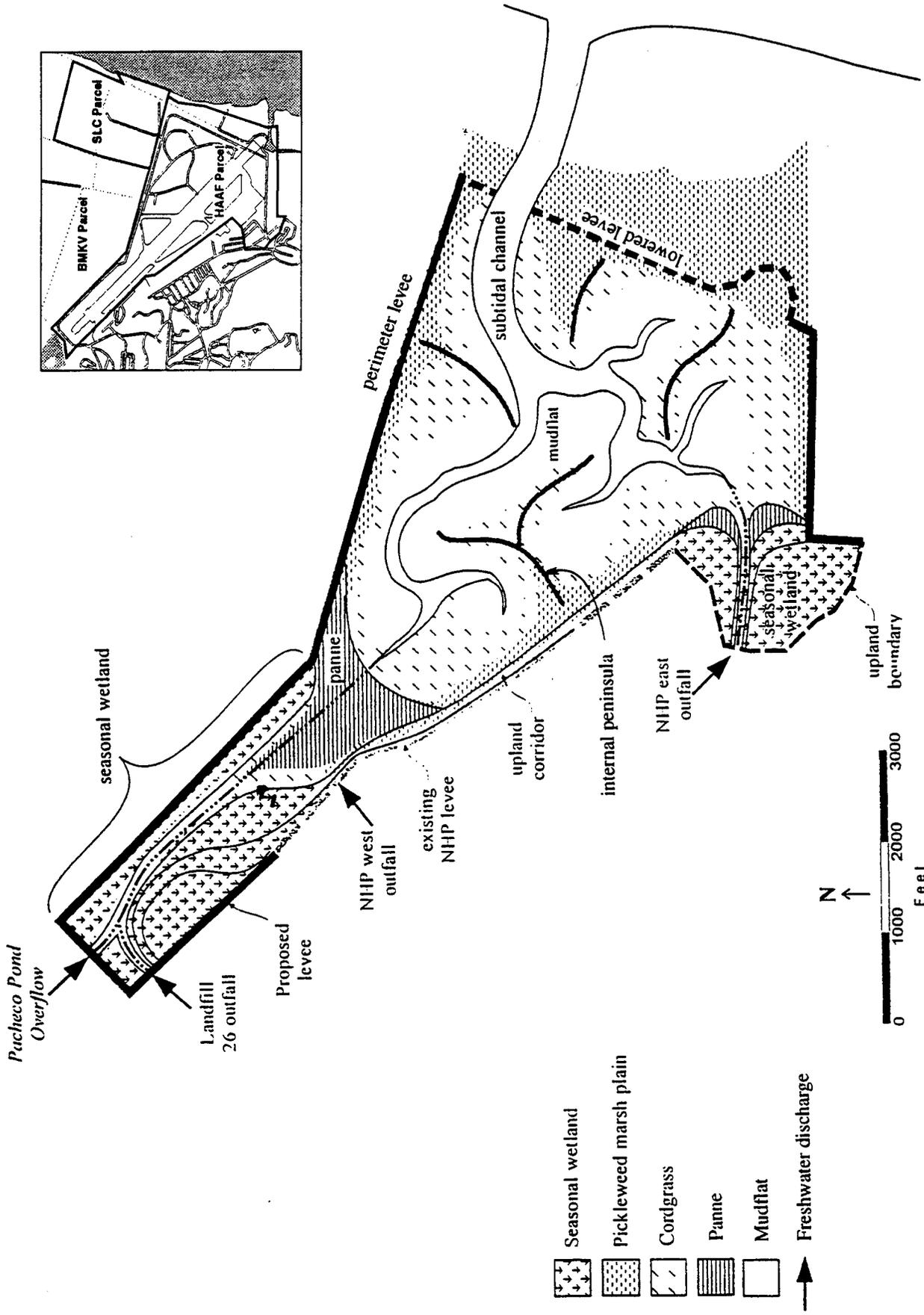


Note:  
 4.5 ft. contour denotes the approximate alignment of dredged material containment dike and the limit of seasonal wetland.



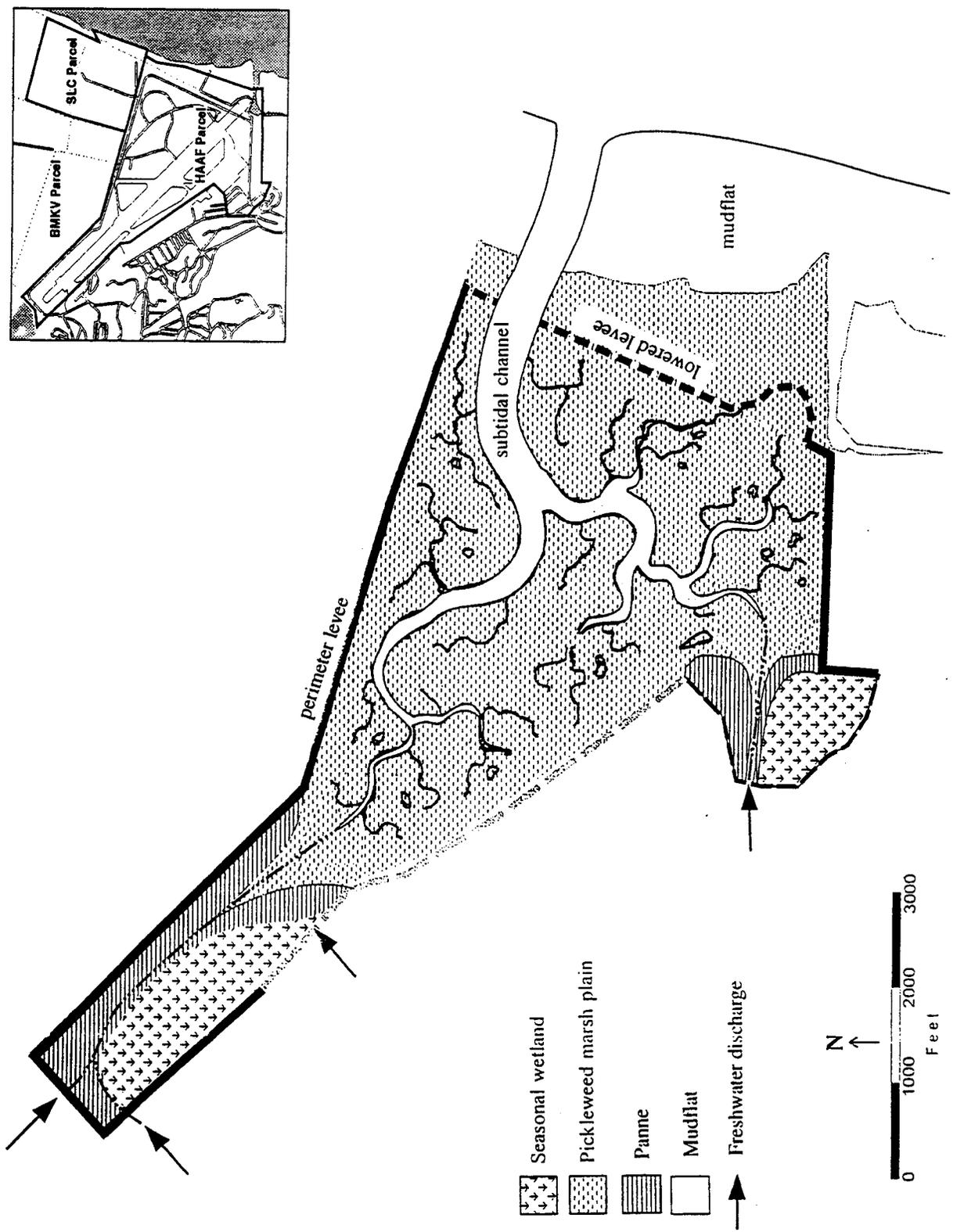
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**Figure 8-6**  
**Development and Distribution of Restored Habitat under**  
**Alternative 3 at Year 0**



**Figure 8-7**  
**Development and Distribution of Restored Habitat under**  
**Alternative 3 at Year 10**





**Figure 8-8**  
**Development and Distribution of Restored Habitat under**  
**Alternative 3 at Year 50**



### **Impact 8.32: Loss of Grassland**

This impact is the same as Impact 8.9 described above for Alternative 2, except that approximately 16 acres of additional grassland habitat areas would be restored. This impact is considered less than significant and no mitigation is required.

### **Impact 8.33: Temporary Disturbance to the California Clapper Rail and California Black Rail during Construction**

This impact is the same as Impact 8.10 described above for Alternative 2. This impact is considered significant. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measure 8.10.

### **Impact 8.34: Temporary Disturbance to the Northern Harrier, Burrowing Owl, Saltmarsh Common Yellowthroat, and San Pablo Song Sparrow during Construction**

This impact is the same as Impact 8.11 described above for Alternative 2. This impact is considered significant. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measure 8.11.

### **Impact 8.35: Potential for Construction-Related Mortality of Chinook Salmon, Central Valley Steelhead, and Longfin Smelt**

Operation of the hydraulic off-loader intake pumps from either of the proposed deep water or shallow water locations in San Pablo Bay could potentially result in mortality of longfin smelt or chinook salmon and Central Valley steelhead salmon smolts during outmigration (smolts of these species could be present in San Pablo Bay from about January 1 to June 30). Mortality to these species could result if fish are entrained in pump intakes; however, because pumping operations are temporary and water would be pumped from the open waters of San Pablo Bay rather than a narrow water body, which could result in channeling fish to the pump intakes, it is unlikely that these species would be entrained by pump operation. Therefore, this impact is considered less than significant.

### **Impact 8.36: Potential for Construction-Related Mortality of Salt Marsh Harvest Mice**

This impact is the same as Impact 8.12 described above for Alternative 2, except that placement of the dredged material pipeline in the tidal marsh could affect the salt marsh harvest mouse in addition to the construction activities identified under Alternative 2. This impact is considered significant. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measure 8.12.

### **Impact 8.37: Potential for Construction-Related Mortality of California Clapper Rails and California Black Rails**

This impact is the same as Impact 8.13 described above for Alternative 2, except that placement of the dredged material pipeline in the tidal marsh could also result in direct mortality of California clapper rails and California black rails. Therefore, this impact is considered significant. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measure 8.37.

**Mitigation Measure 8.37: Avoid Operation of Equipment in the Outboard Tidal Marsh during the Breeding Period for California Clapper Rail and California Black Rail.** This measure is the same as Mitigation Measure 8.13 described above for Alternative 2, except that the measure is expanded to include placement of the dredged material pipeline in the outboard tidal marsh as an additional activity to be avoided from April 15 through July 15.

### **Impact 8.38: Potential for Mortality of San Pablo Song Sparrows**

This impact is the same as Impact 8.14 described above for Alternative 2. This impact is considered significant. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measure 8.14.

### **Impact 8.39: Potential for Mortality of Burrowing Owls**

This impact is the same as Impact 8.15 described above for Alternative 2. This impact is considered significant. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measure 8.15.

### **Impact 8.40: Potential Disturbance to or Mortality of Special-Status Species resulting from Management and Maintenance Activities**

This impact is the same as Impact 8.16 described above for Alternative 2. This impact is considered significant. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measure 8.16.

### **Impact 8.41: Loss of Habitat for California Clapper Rail, California Black Rail, Salt Marsh Harvest Mouse, and Saltmarsh Common Yellowthroat**

This impact is the same as Impact 8.17 described above for Alternative 2, except that slightly more habitat area would be affected and slightly less habitat area would be restored under Alternative 3. This impact is considered significant. To reduce this impact

to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measure 8.4.

**Impact 8.42: Loss of Refugia for the California Clapper Rail, California Black Rail, and Salt Marsh Harvest Mouse**

This impact is the same as Impact 8.18 described above for Alternative 2. This impact is considered less than significant and no mitigation is required.

**Impact 8.43: Loss of Nesting Habitat for the San Pablo Song Sparrow**

This impact is the same as Impact 8.19 described above for Alternative 2. This impact is considered significant. To reduce this impact to a less-than-significant level, the Coastal Conservancy, Corps, or successors in interest shall implement Mitigation Measures 8.4 and 8.5.

**Impact 8.44: Loss of Nesting Habitat for the Burrowing Owl**

This impact is the same as Impact 8.20 described above for Alternative 2. This impact is considered less than significant and no mitigation is required.

**Impact 8.45: Increase in Suitable Nesting Habitat for the Northern Harrier**

This impact is the same as Impact 8.21 described above for Alternative 2. This impact is considered beneficial.

**Impact 8.46: Increase in Suitable Habitat for the Brown Pelican and Double-Crested Cormorant**

This impact is the same as Impact 8.22 described above for Alternative 2. Dredged material would be placed in areas restored to tidal flow, however, and tidal salt marsh vegetation would establish more rapidly because the site is expected to aggrade to elevations that would sustain vegetation earlier in the process of site evolution. Consequently, open water areas would develop to mudflats and tidal coastal salt marsh sooner following introduction of tidal exchange to the site than under Alternative 2. This impact is considered beneficial.

#### **Impact 8.47: Increase in Suitable Nesting Habitat for Resident Waterfowl**

This impact is the same as Impact 8.23 described above for Alternative 2. This impact is considered beneficial.

#### **Impact 8.48: Increase in Suitable Habitat for Wintering Waterfowl**

This impact is the same as Impact 8.24 described above for Alternative 2. This impact is considered beneficial.

#### **Impact 8.49: Increase in Suitable Habitat for Migratory Shorebirds**

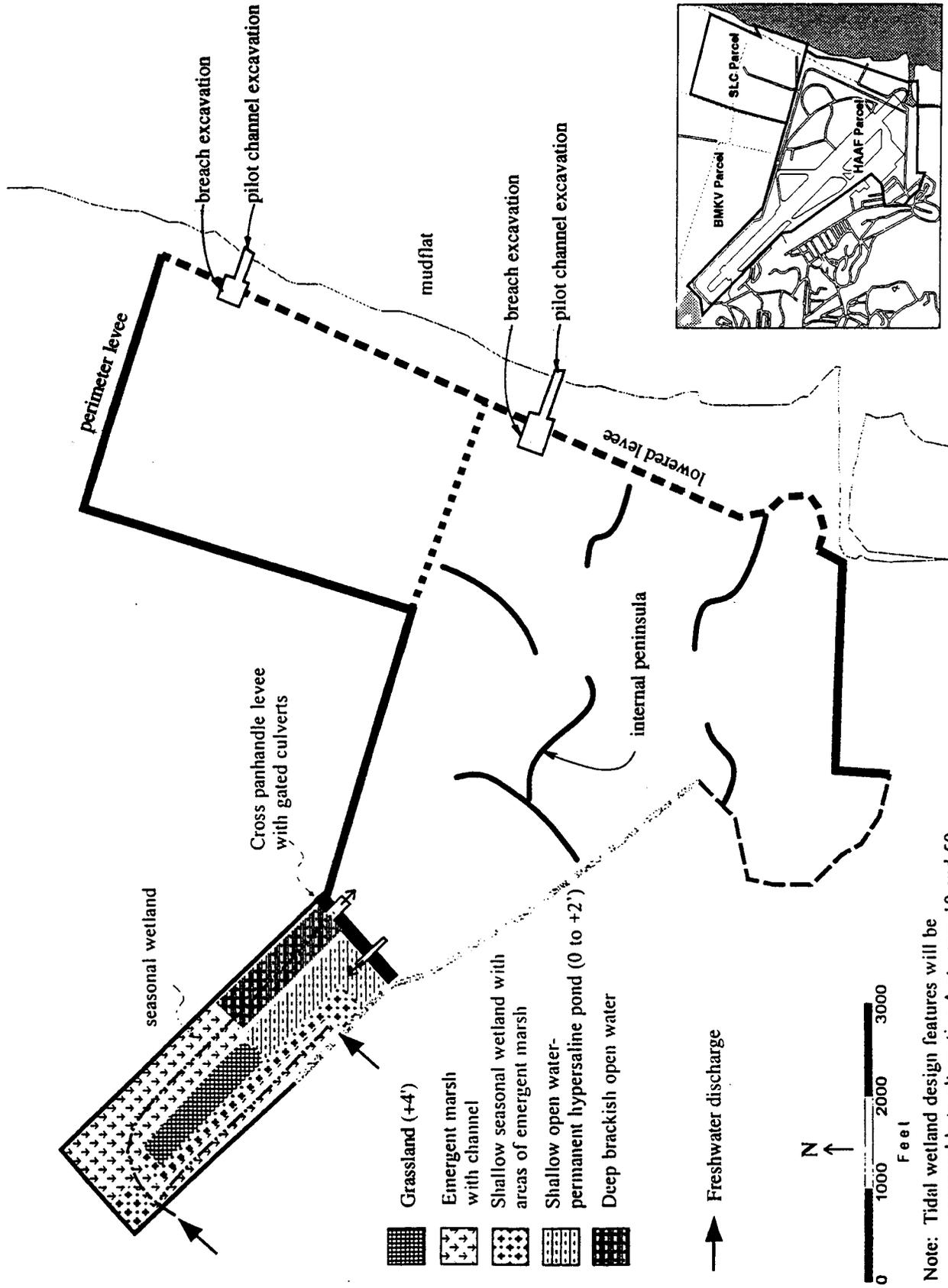
This impact is the same as Impact 8.25 described above for Alternative 2. Dredged material would be placed in areas restored to tidal flow, and tidal salt marsh vegetation would establish more rapidly because the site is expected to aggrade to elevations that would sustain vegetation earlier in the process of site evolution. Consequently, tidal mudflats would develop to tidal coastal salt marsh earlier following introduction of tidal exchange to the site than under Alternative 2. Under Alternative 3, approximately 33 acres of tidal pannes would be created that, in addition, would provide foraging habitat and flood refugia for shorebirds when tidal marshes are inundated by high tides (Table 8-3). This impact is considered beneficial.

#### **Impact 8.50: Temporary Disturbance of Fish in San Pablo Bay during Construction**

Transporting dredged material to the site would require pumping the material through the dredged material pipeline<sub>s</sub> across part of San Pablo Bay from a hydraulic off-loaders<sub>s</sub>, also located in the bay. This process could increase the turbidity surrounding the hydraulic off-loaders<sub>s</sub> and create the potential for fuel spills, causing a disturbance to the fish species in the area; however, fish are likely to move out of the area until the water quality increases. All construction activities must meet the objectives established by the San Francisco RWQCB. Therefore, this impact is considered less than significant and no mitigation is required.

### **Impacts and Mitigation Measures Unique to Alternative 4**

Figures 8-9 to 8-11 (depicting the HAAF and SLC parcels) illustrate the predicted development and distribution of restored habitats at years 0, 10, and 50, respectively, following implementation of Alternative 4. Table 8-2 presents a comparison between the acreages of habitats restored under Alternative 4 and acreages under Alternative 1 (and Alternatives 2, 3, and 5) at year 50. Table 8-3 presents the expected net change in habitat acreages from Alternative 1 with implementation of Alternative 4.

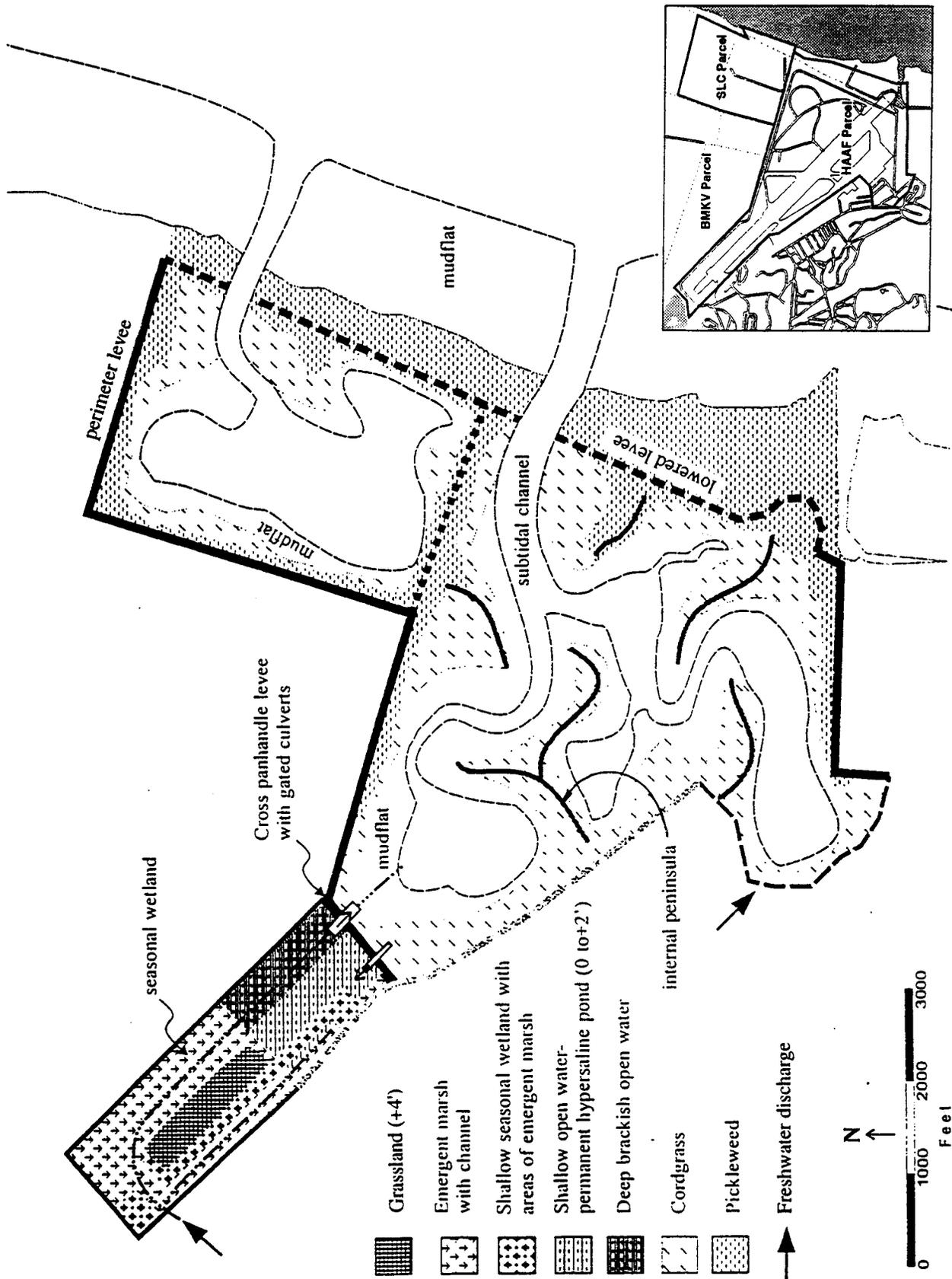


Note: Tidal wetland design features will be comparable to alternative A at years 10 and 50



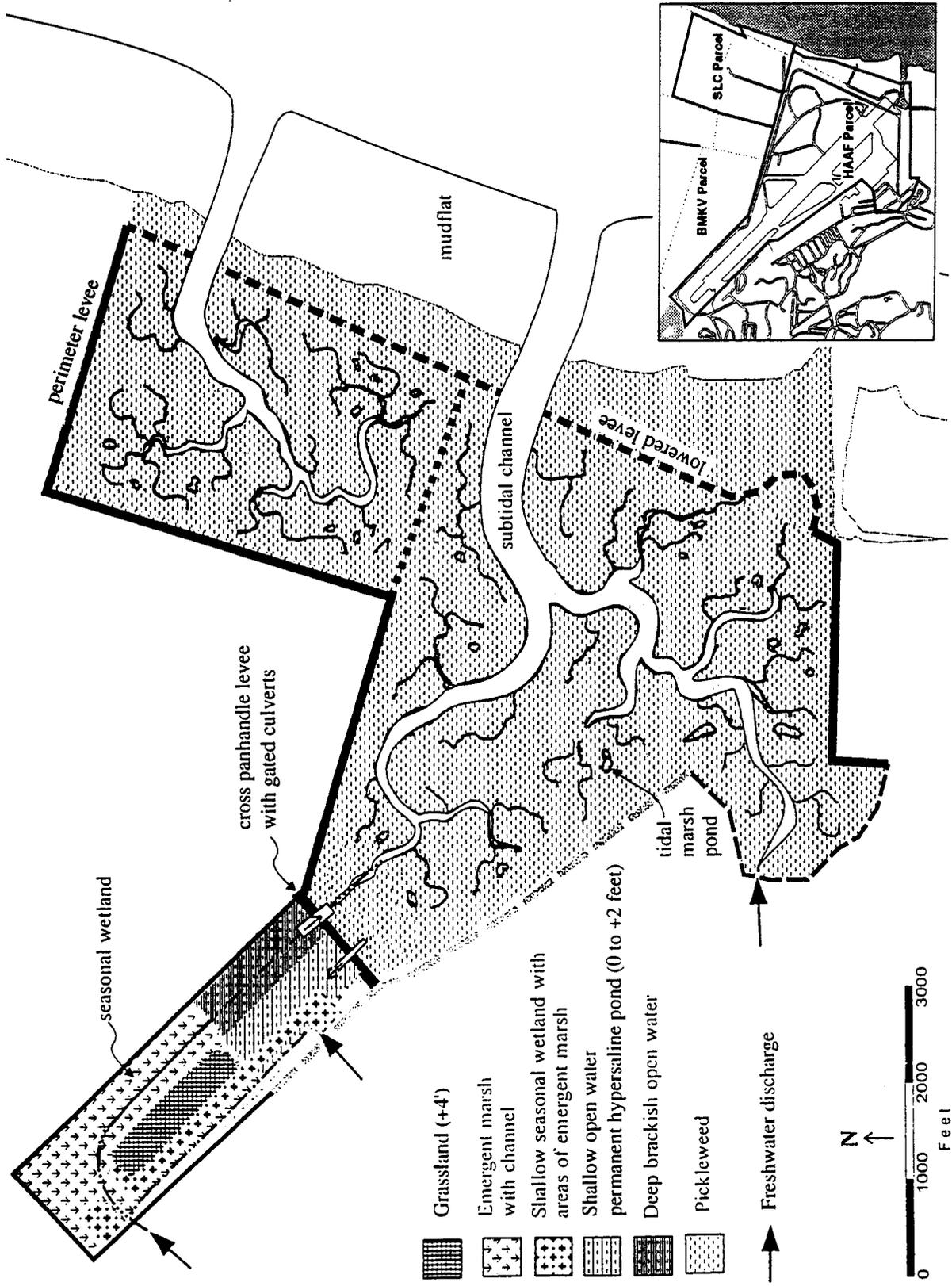
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**Figure 8-9**  
**Development and Distribution of Restored Habitat under**  
**Alternative 4 at Year 0**



**Figure 8-10**  
**Development and Distribution of Restored Habitat under**  
**Alternative 4 at Year 10**





**Figure 8-11**  
**Development and Distribution of Restored Habitat under**  
**Alternative 4 at Year 50**



Alternative 4 is similar to Alternative 2, except that approximately 250 acres of additional coastal salt marsh and grassland habitat in the SLC parcel would be restored. The impacts and mitigation measures of Alternative 4 are the same as those described for Alternative 2, except that the magnitude of impacts and benefits differ. Differences between the magnitude of impacts and benefits of Alternative 4 and Alternative 2 compared to Alternative 1 are presented in Table 8-3.

## **Impacts and Mitigation Measures Unique to Alternative 5**

Figures 8-12 to 8-14 (depicting the HAAF and SLC parcels) illustrate the predicted development and distribution of restored habitats at years 0, 10, and 50, respectively, following implementation of Alternative 5. Table 8-2 presents a comparison between the acreages of habitats estimated to be restored under Alternative 5 and acreages under Alternative 1 (and Alternatives 2, 3, and 4) at year 50. Table 8-3 presents the expected net change in habitat acreages from Alternative 1 with implementation of Alternative 5. Alternative 5 is similar to Alternative 3, except that approximately 250 acres of additional coastal salt marsh and grassland habitat on the SLC site would be restored. The impacts and mitigation measures of Alternative 5 are the same as those described for Alternative 3, except that the magnitude of impacts and benefits differ. Differences between the magnitude of impacts and benefits of Alternative 5 and Alternative 3 compared to Alternative 1 are presented in Table 8-3.

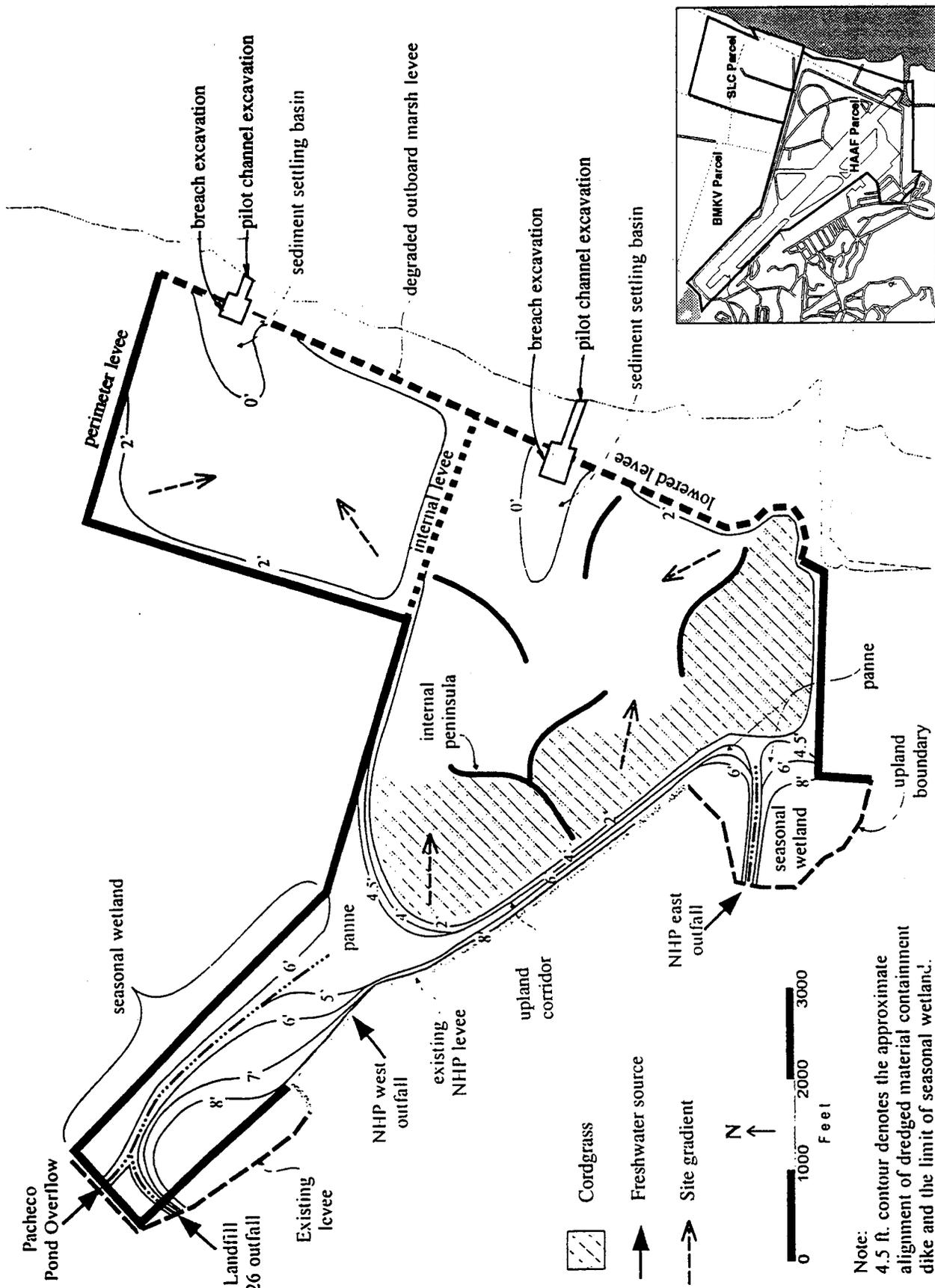
## **Potential Issues and Resolutions under the Bel Marin Keys V Scenario**

The Coastal Conservancy and the Corps are considering this scenario at a programmatic level in the event that the BMKV parcel can be acquired for restoration before one of the other project alternatives can be implemented. Conceptually, the habitat types to be restored and the methods used to restore the habitats would be same as those proposed under Alternative 5.

The BMKV Scenario is similar to Alternative 5, except that approximately 1,358 acres of additional coastal salt marsh, tidal panne, seasonal wetland, and grassland habitat in the BMKV parcel would be restored (Table 8-4). With the exception of biological resources associated with agricultural habitats, the potential issues and resolutions under the BMKV Scenario are similar to those described for Alternative 5, except that the magnitude of effects and benefits would differ. Differences between the magnitude of effects and benefits of the BMKV Scenario and Alternative 5 compared to Alternative 1 are presented in Tables 8-3 and 8-4.

### **Potential Issue: Potential Loss of Wintering Waterfowl and Shorebird Foraging Habitat**

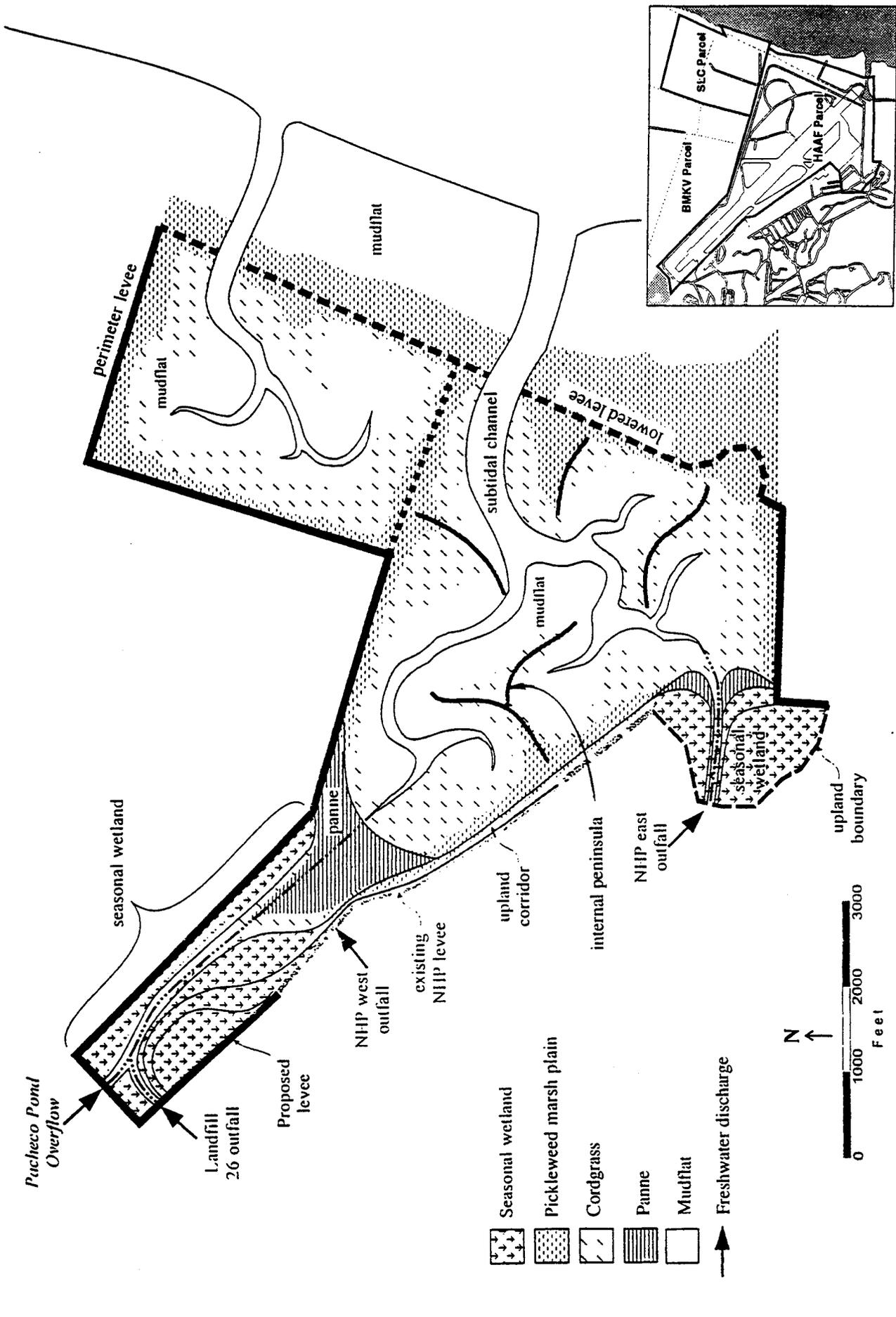
Loss of approximately 1,314 acres of agricultural land with restoration of the BMKV parcel would result in the loss of foraging areas for wintering waterfowl and shorebird. Restoring the extensive mosaic of approximately 1,358 acres of intertidal mudflats, coastal salt marsh, brackish marsh, seasonal wetland, and grassland habitats under this alternative would likely provide foraging and resting habitat values at least as high as those areas that would be affected by the project. Therefore, this potential issue is considered less than significant.



**Figure 8-12**  
**Development and Distribution of Restored Habitat under**  
**Alternative 5 at Year 0**

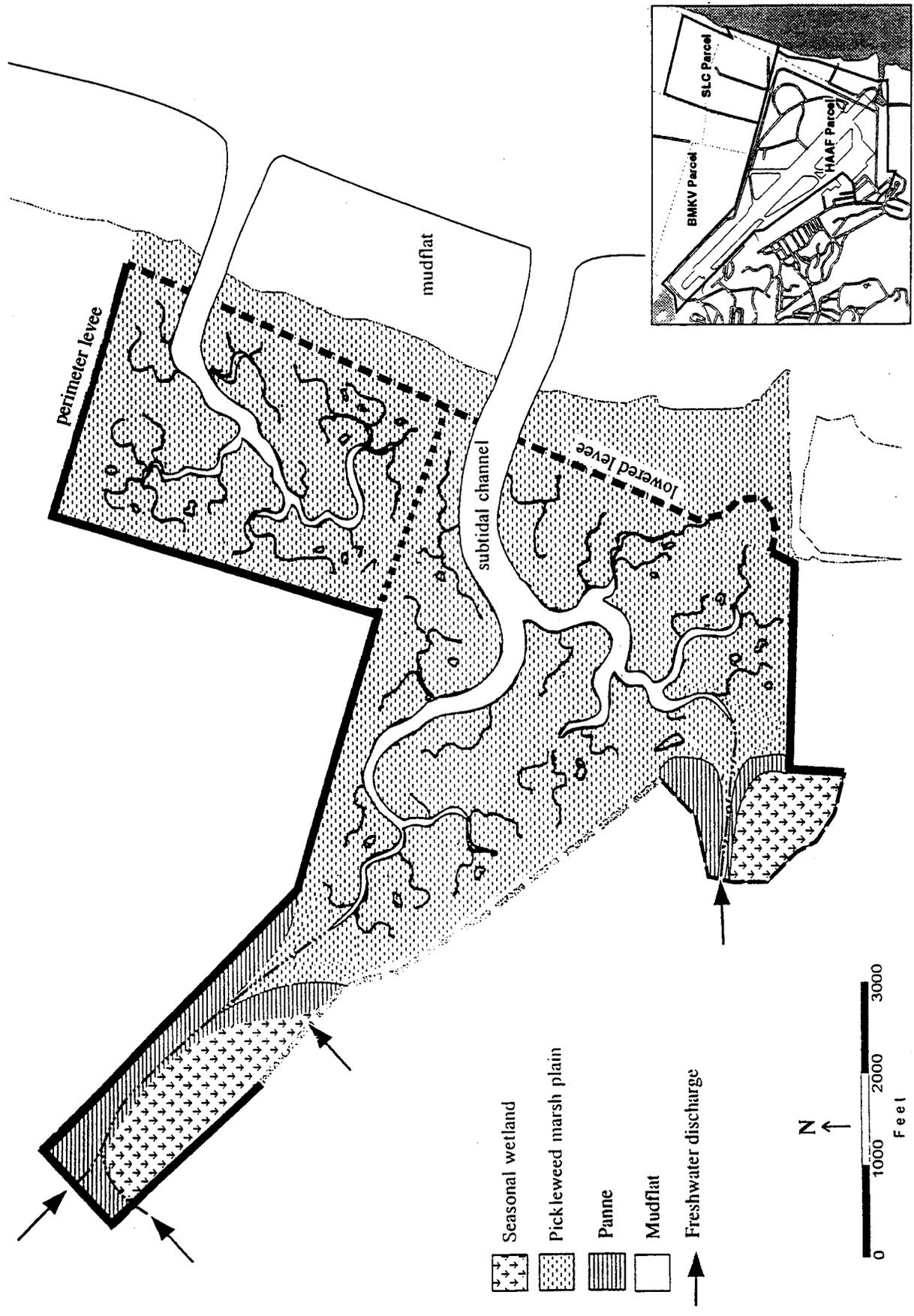
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**Figure 8-13**  
**Development and Distribution of Restored Habitat under**  
**Alternative 5 at Year 10**





**Figure 8-14**  
**Development and Distribution of Restored Habitat under**  
**Alternative 5 at Year 50**

**Table 8-4.**  
**Estimated Acreage of Each Habitat Type and Net Change in**  
**Habitat Acreage under the Bel Marin Keys V Scenario**  
**Compared to Alternative I at Year 50 after Project Implementation**

Habitat Type	Alternative I: No Action <sup>a</sup>	Bel Marin Keys V Scenario	
		Estimated Restored Habitat Area	Net Change from Alternative I
Subtidal channels	0.0	93.5	+93.5
Intertidal channels	0.0	52.3	+52.3
Coastal salt marsh (tidal)	120.0	1,561.2	+1,441.2
Coastal salt marsh (nontidal)	11.0	0.0	-11.0
Tidal pannes	0.0	98.5	+98.5
Brackish marsh	31.1	0.0 <sup>b</sup>	-31.1 <sup>b</sup>
Brackish open water	13.0	0.0 <sup>b</sup>	-13.0 <sup>b</sup>
Seasonal wetland	37.5	295.4 <sup>c</sup>	+257.9 <sup>c</sup>
Grassland	496.7	205.9	-290.8
Agriculture	1,314.0	0.0	-1,314.0
Developed areas	283.6	0.0	-283.6
<b>Total</b>	<b>2,306.9</b>	<b>2,306.9</b>	<b>0.0</b>

<sup>a</sup> Acreages for Alternative 1 include the HAAF, SLC, and BMKV parcels.

<sup>b</sup> An unknown quantity of brackish marsh and brackish open water will develop as inclusions within restored seasonal wetland habitat areas.

<sup>c</sup> This amount will include an unknown quantity of brackish marsh and brackish open water habitat area.