Chapter 4

Affected Environment and Environmental Consequences

This chapter presents the affected environment and the environmental consequences and mitigation measures of the proposed BMKV expansion. The analysis of environmental consequences is based on the conceptual designs for wetland restoration presented in the previous chapter. Each of the restoration alternatives and the No-Action Alternative are analyzed in terms of the following resource topics.

- Geology, Soils, and Seismicity
- Surface-Water Hydrology and Tidal Hydraulics
- Water Quality
- Public Health
- Biological Resources
- Land Use and Public Utilities
- Hazardous Substances and Waste
- Transportation
- Air Quality
- Noise
- Cultural Resources

The focus of the analysis of environmental consequences is limited to the determination of whether the restoration alternatives would result in a "significant effect on the environment," according to CEQA, or would "significantly affect the quality of the human environment," according to NEPA.

CEQA defines a *significant effect on the environment* as "a substantial, or potentially substantial, adverse change in the environment" (PRC Div. 13 21068). CEQA Guideline 15382 describes *adverse change* as an "adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance."

CEQ NEPA Guideline 1508.14 defines the *human environment* as "the natural and physical environment and the relationship of people with that environment." *Significantly,* as used in NEPA, requires considerations of both context and intensity (CEQ NEPA Guideline 1508.27).

Specific significance threshold criteria that were used to evaluate the significance of potential effects of the proposed restoration alternatives are presented below in the discussion of each subject area.

Geology, Soils, and Seismicity

Affected Environment

Data Sources

This section is based on previous geotechnical investigations and environmental studies performed within the BMKV site and neighboring areas. The primary sources of information used to prepare this section include the following documents.

- *Geotechnical Investigation Bel Marin Keys Unit 5* (Miller Pacific Engineering Group 1995)
- *Bel Marin Keys Unit V Final Environmental Impact Report/Environmental Impact Statement* (Environmental Science Associates 1993)

Regional Geology and Topography

The expansion site is located within California's geologically and seismically active Coast Ranges Geomorphic Province. The province is characterized by a series of northwest-trending faults, mountain ranges, and valleys (figure 4-1) (Environmental Science Associates 1993).

The expansion site consists of former mudflats and marshlands that constitute a portion of the nearly level Bay Plain geomorphic zone, which extends from the edge of San Pablo Bay to the foot of the hills located immediately west of the site. The construction of agricultural levees in 1892, and subsequent agricultural land drainage activities, caused the expansion site to settle to its current elevation of -4 to -5 feet National Geodetic Vertical Datum (NGVD) (Miller Pacific Engineering 1995).

The expansion site is underlain entirely by bay mud, which consists of soft, unconsolidated silty clays that typically exhibit low permeability, high compressibility, and low shear strength. The thickness of the bay mud deposits

located beneath the project site ranges from 90 feet near San Pablo Bay to 20 feet near Pacheco Pond. Bay mud deposits in the expansion area are typically underlain by much stronger and less compressible soils and geologic deposits. The groundwater table beneath the expansion site typically resides from 2 to 4 feet below the ground surface but often nears the surface during the rainy season (Miller Pacific Engineering Group 1995).

Soils

According to the Soil Survey of Marin County (Kashiwagi 1985), the bay mud deposits that underlie the expansion site are overlain entirely by soils of the Reyes series. Soils of the Reyes series typically consist of slowly permeable clays and silty clays. The near-surface horizon of the Reyes soil at the expansion site is referred to as a "desiccated crust" by Miller Pacific Engineering Group (1995), apparently because their textural properties do not contrast significantly with those of the underlying bay mud deposits. The Reyes soils are more consolidated than underlying bay mud deposits but are still susceptible to settlement when dewatered or subjected to large static-fill loads (Miller Pacific Engineering Group 1995). Due to the fine texture of the Reyes soil and the low slope gradients that prevail at the expansion site, the hazard of soil erosion is slight.

Seismicity and Geologic Hazards

The expansion site is located in one of the most seismically active regions in the United States. The site's seismic setting is dominated by the Hayward fault to the southeast, the San Andreas fault to the west, and the Healdsburg–Rogers Creek fault to the northeast (figure 4-1). The maximum credible earthquake for each of these faults, measured in Richter scale magnitude (M), is as follows.

- Hayward fault—7.5 M
- San Andreas fault—8.3 M
- Healdsburg–Rogers Creek fault—7.2 M

Two smaller, potentially active faults are near the expansion site. A possible trace of the Burdell Mountain fault is mapped as extending toward and terminating north and west of the expansion site. Estimates differ regarding the date of the last displacement on the Burdell Mountain fault. It is generally thought to have been active during the Quaternary period (the last 2.5 million years), and some evidence suggests that it may have been active during the Holocene epoch (the last 11,000 years) (Environmental Science Associates 1993). The Tolay fault also reaches to within 6.5 miles of the expansion site and may be active (Robert Bein, William Frost & Associates 1995).

The expansion site is likely to undergo ground shaking from a major earthquake. The U.S. Geological Survey (USGS) has estimated that there is a 67% probability that there will be 1 or more earthquakes of magnitude 7.0 or greater in the Bay Area in the next 30 years (Environmental Science Associates 1993).

Four major hazards are associated with earthquakes: surface fault rupture, ground shaking, ground failure, and inundation resulting from earthquake-generated waves (tsunamis or seiches).

Ground Shaking

Factors that would affect the intensity of ground shaking at the expansion site during an earthquake on a nearby fault include the following.

- Characteristics of the fault generating the earthquake
- Distance to the fault and earthquake hypocenter
- Earthquake magnitude
- Earthquake duration
- Site-specific geologic conditions (i.e., the nature of the geologic materials underlying the expansion site) (Miller Pacific Engineering Group 1995)

Unconsolidated materials tend to amplify ground shaking to a greater extent than bedrock. Accordingly, ground shaking during an earthquake would likely be more intense at the expansion site than in nearby areas underlain by bedrock.

Surface Fault Rupture

No active or potentially active faults are known to exist within the boundaries of the expansion site. In addition, the expansion site is not within an Alquist–Priolo Special Studies Zone, as designated by the California Division of Mines and Geology (Hart and Bryant 1997). Accordingly, the potential for surface fault rupture to occur at the expansion site is remote (Miller Pacific Engineering Group 1995).

Ground Failure

Ground-failure hazards of potential concern at the site include liquefaction, earthquake-induced settlement, and lurching. All of these processes involve the displacement of the ground surface resulting from a loss of strength or failure of the underlying materials because of ground shaking.

Liquefaction is the sudden loss of soil strength during strong ground shaking, which results in temporary fluid-like behavior of the affected soil materials.

Liquefaction typically occurs in areas where groundwater is shallow and materials consist of clean, poorly consolidated, fine sands and silts. The Reyes soils and bay mud deposits that underlie the expansion site are not conducive to liquefaction because they do not contain substantial quantities of clean sands and silts (Miller Pacific Engineering Group 1995).

Ground shaking can also induce the settlement of loose, granular soils (i.e., clean sands and silts) located above the groundwater table. The Reyes soils and bay-mud deposits that underlie the expansion site consist of clays and silty clays rather than clean sands and silts. Thus, there is no potential for seismic settlement to occur at the expansion site (Miller Pacific Engineering Group 1995).

Lurching, or lurch cracking, is the cracking of the ground surface in soft, saturated material as a result of earthquake-induced ground shaking. Lurch cracking generally occurs along the edge of steep embankments where stiff soils (e.g., manufactured fill materials) are underlain by soft, compressible soils and geologic deposits (Miller Pacific Engineering Group 1995). Because the expansion site is underlain by soft, compressible bay-mud deposits, there is a potential for earthquake-induced lurch cracking to occur at the expansion site during an earthquake (Miller Pacific Engineering Group 1995).

Earthquake-Induced Inundation (Tsunamis and Seiches)

Tsunamis are sea waves produced by large-scale seismic events on the ocean floor. Seiches are earthquake-generated waves that form in enclosed water bodies, such as lakes or tidal marshes. Both can cause temporary inundation of upland areas. Due to its proximity to San Pablo Bay, there is a potential for the expansion site to be affected by tsunamis and seiches.

A tsunami with a 100-year recurrence interval (i.e., a 1% probability of occurrence in a given year) has an estimated run-up of 3 feet in the vicinity of the expansion site (Miller Pacific Engineering Group 1995). Likewise, a seiche generated in the vicinity of the expansion site is expected to be relatively small (less than a few feet) (Miller Pacific Engineering Group 1995). At its current elevation, the expansion site could be flooded by a tsunami in the event that the existing outboard levee fails or is overtopped (Environmental Science Associates 1993).

Environmental Consequences and Mitigation Measures

Approach and Methods

The following evaluation of potential geologic, seismic, and soil-related impacts associated with potential restoration was based on a review of geotechnical reports prepared for restoration and development in and immediately adjacent to the expansion site, the professional opinions rendered in these reports, and professional judgement.

Impact Mechanisms

The following restoration-related activities and natural processes could result in accelerated soil erosion; loss of nonrenewable soil or geological resources; personal injury; loss of life; or substantial damage to property, structures, or related improvements.

- Mass land grading and other forms of soil and vegetation disturbance
- Placement of fill materials on weak, compressible bay-mud deposits
- Earthquake-induced ground shaking

Thresholds of Significance

The following significance criteria were used to evaluate the proposed BMKV expansion. Regarding geology, soils, and seismicity, the proposed expansion was considered to result in a significant impact if it would

- result in a substantial change in topography or the destruction of any unique geologic formation or soil type;
- result in substantial soil erosion or the loss of nonrenewable soil resources;
- substantially degrade physical, chemical, or biological soil quality, and thereby degrade the ability of onsite soils to support sensitive habitats, such as wetlands;
- cause personal injury, loss of life, or substantial damage to property, structures, or site improvements as a result of *existing* geologic, seismic, or soil-related hazards; or
- cause personal injury, loss of life, or substantial damage to property, structures, or site improvements as the result of geologic, seismic, or soil-related hazards that would be *created* during the construction and operation of the restoration site.

Impacts and Mitigation Measures of No-Action Alternative

Impact G-1: Continued Land-Surface Settlement, Substantial Alteration of Natural Topography, and Loss of Soil Resources Capable of Supporting Sensitive Wetland Habitats

Under the No-Action Alternative, the expansion site would continue to be used for limited agricultural production. If the expansion site continued to be used for agricultural production, ground-surface settlement would likely continue to occur at its existing rate.

Impacts and Mitigation Measures Common to Alternatives 1–3

Impact G-2: Settlement of Proposed Levees, Uplands, Seasonal Wetlands, and Tidal Wetlands in Response to the Placement of Static Fill Loads

Implementation of Alternatives 1–3 would involve the construction of levees in the northwestern portion of the expansion site. Alternatives 1 and 2 would also involve the placement of dredged materials to create upland, seasonal wetland, and tidal wetland habitats. The Reyes clay soils and the bay-mud deposits that underlie the expansion site are compressible and therefore susceptible to settlement. The static loads imposed on these materials from the construction of levees and the placement of dredged materials would result in some degree of ground-surface settlement. The resulting settlement could be *uniform*, which would involve relatively uniform settlement over the affected area, or *differential*, which would involve unequal settlement over the affected area. Both types of settlement could affect the structural integrity of and/or reduce the level of flood protection provided by the levees. Additionally, ground-surface settlement resulting from the placement of dredged materials could temporarily inhibit the development of some of the proposed upland, seasonal wetland, and tidal wetland habitats.

The type (i.e., uniform or differential), ultimate amount, and rate of settlement that would occur would depend on the amount of fill placed, thickness of the underlying bay mud, and elevation of groundwater beneath the expansion site (Miller Pacific Engineering Group 1995). Uniform settlement is most likely to occur in areas where the thickness of both fill and underlying bay-mud deposits is relatively uniform (e.g., in the vicinity of the proposed tidal sub-basins). Conversely, differential settlement is most likely to occur in areas where there are significant differences in the thickness of fill and abrupt changes in the thickness of the underlying bay-mud deposits (e.g. near Pacheco Pond). The

ultimate amount of settlement would increase proportionately with thickness of fill and underlying bay-mud deposits. The rate of settlement would increase with the thickness of fill but decrease with the thickness of the underlying bay-mud deposits. Most settlement is expected to occur within the first 30–50 years after fill placement; settlement would slow appreciably after that time (Miller Pacific Engineering Group 1995; Jones & Stokes Associates1996).

Detailed geotechnical investigations and analyses would be conducted during the final design stage of the proposed BMKV expansion to address the levee construction and dredged-material placement components of the selected restoration alternative with respect to settlement. These design-level investigations would identify and evaluate subsurface conditions encountered at the expansion site (e.g., thickness and compressibility of the bay-mud deposits) and describe how settlement would be mitigated and compensated for through the implementation of standard engineering methods. The specific techniques used to minimize and compensate for anticipated settlement would depend on the findings of the design-level geotechnical investigations, but could include:

- placement of additional fill above the intended finish grade of levees to compensate for anticipated settlement and sea-level rise;
- application of surcharge loads or other settlement acceleration techniques, such as the installation of wick drains; and
- uniform placement of fill during construction and avoidance of excessive fill placement.

Because the final design of the selected restoration alternative would be based on detailed subsurface investigations and would incorporate appropriate measures to adequately mitigate and/or compensate for anticipated settlement, this impact is considered less than significant.

Impact G-3: Potential Levee Slope Failure Resulting from the Low Shear Strength of Underlying Bay-Mud Deposits

Implementation of Alternatives 1–3 would involve the construction of levees in the northwestern portion of the expansion site. The shear strength of the bay-mud deposits on which these levees would be constructed varies with depth and prior loading conditions, but it is typically relatively low (Environmental Science Associates 1993; Miller Pacific Engineering Group 1995; Jones & Stokes Associates 1996). Although the shear strength of the bay-mud deposits would increase over time as they consolidate in response to the static fill loads imposed by the levees, the initially low strength of the bay-mud deposits could destabilize the levee embankments and possibly cause them to fail if the levees are not constructed correctly. Levee failure or destabilization would decrease the level of tidal flood protection provided by the proposed levees. Other factors that would influence the stability of the proposed levee embankments include the type and shear strength of the material used to construct the levees, height and

gradient of the levee embankments, and depth to which the proposed levees are inundated.

Detailed geotechnical investigations and analyses would be conducted during the final design of the selected restoration alternative to evaluate the engineering properties of the materials that would be used to construct the proposed levees and the bay-mud deposits on which the levees would be constructed. Based on the findings of these design-level investigations, standard engineering techniques would be incorporated into the final design and construction of the levees to minimize the potential for levee failure or destabilization. The specific techniques used to minimize the potential for levee failure and destabilization would depend on the findings of the design-level geotechnical investigations but could include:

- placement of levee fill in stages so that low strength bay-mud deposits are not overstressed;
- uniform placement of fill during construction and avoidance of excessive fill placement;
- application of surcharge loads or other settlement acceleration techniques, such as installation of wick drains, to increase the shear strength of underlying bay-mud deposits; and
- placement of stabilizing fill against the base of the proposed levees (permanent toe berms).

Because the final design of the selected alternative would be based on detailed subsurface investigations and would incorporate standard design and construction techniques to adequately minimize the potential for levee failure and destabilization, this impact is considered less than significant.

Impact G-4: Potential Short-Term Increase in Erosion and Sedimentation Rates during Construction

Many of the activities that would be conducted during the construction of Alternatives 1–3, such as the establishment and use of a equipment staging area, lowering of the levee adjacent to Novato Creek, and improvement of the existing levee located south of the BMK lagoon, would result in disturbances to soil and existing vegetation. Although the erosion hazard throughout the expansion area is slight under normal conditions, these and other construction-related disturbances would expose bare soil to erosion by water and wind and could increase erosion and sedimentation rates above pre-construction levels. However, a Storm Water Pollution Prevention Plan (SWPPP) would be prepared and implemented to address these and other construction-related erosion and sedimentation issues and to comply with the requirements of the National Pollutant Discharge Elimination System (NPDES) general construction activity stormwater permit or other individual permit issued and administered by the

California State Water Resources Control Board. The SWPPP would prescribe temporary measures to control accelerated erosion and sedimentation in disturbed areas during construction, and permanent measures to control accelerated erosion and sedimentation once construction is complete. Implementation of the SWPPP would substantially reduce the potential for accelerated erosion and sedimentation to occur as a result of construction. Therefore this impact is considered less than significant.

Sedimentation issues associated with the placement of dredged material and levee construction are addressed in the *Water Quality* section of this chapter.

Impact G-5: Potential Damage to Proposed Levees Resulting from Earthquake-Induced Ground Shaking and Lurch Cracking

The expansion site is likely to experience ground shaking from a major earthquake in the next 70 years. Because the expansion site is underlain by unconsolidated bay-mud deposits, ground shaking likely would be more intense at the expansion site than in adjacent areas underlain by bedrock. Earthquake-induced ground shaking and associated lurch cracking could damage the levees proposed under Alternatives 1–3 and possibly increase the potential for tidal flooding in adjacent residential communities.

Detailed geotechnical investigations and analyses would be conducted during the final design of the selected restoration alternative to evaluate the engineering properties of the materials that would be used to construct the proposed levees and bay-mud deposits on which levees would be constructed. Based on the findings of these design-level investigations, standard engineering techniques would be incorporated into the final design and construction of the proposed levees to minimize the potential for lurch cracking and levee displacement during episodes of strong ground shaking. In addition, the conceptual restoration design already includes features that would minimize the potential for flooding in the event that the proposed flood control levees were damaged during an earthquake. These include (i) the installation of an outlet (culvert with flap gate) to Novato Creek and (ii) the improvement of the existing levee located between the expansion site and the BMK south lagoon (see figures 3-1, 3-5, and 3-8 in chapter 3 of this document).

Because the final restoration design would include specific design criteria to adequately minimize the potential for lurch cracking and levee displacement during an earthquake and the conceptual designs for Alternatives 1–3 already incorporate measures to minimize the potential for flooding in the event that the proposed flood control levees are damaged during an earthquake, this impact is considered less than significant.

Impact G-6: Potential Exposure of Levees and Sensitive Wetlands to Tsunamis or Seiches

The expansion site is located adjacent to San Pablo Bay and would contain partially enclosed bodies of water (i.e., tidal marshes) if any of the restoration alternatives is constructed. As such, the expansion site could be subjected to a tsunami or a seiche during the lifetime of the proposed BMKV expansion. However, the projected run-up for seiches and tsunamis with 100-year recurrence intervals is relatively small (≤3 feet) (Miller Pacific Engineering Group 1995). The levees proposed under Alternatives 1–3 would be constructed sufficiently high to prevent them from being overtopped by a seiche- or tsunami-induced run-up of this magnitude. Likewise, a seiche or tsunami of this magnitude would likely have little permanent effect on the restored tidal marshes located on the outboard side of the proposed levees. Therefore, this impact is considered less than significant.

Surface-Water Hydrology and Tidal Hydraulics

This section discusses the physical effects of the restoration alternatives on surface-water hydrology and tidal hydraulics. Potential effects of the proposed BMKV expansion on flood overlay zoning and existing drainage agreements are also discussed in this section.

Affected Environment

Data Sources

The evaluation of hydrology is based on information contained in *Hydrologic and Hydraulic Modeling Assessment of Existing and Project Alternatives at Bel Marin Keys V* (Northwest Hydraulic Consultants 2002) included as appendix B of this document, as well as the following sources.

- *Hamilton Wetlands Conceptual Restoration Plan* (Woodward-Clyde 1998)
- *Flood and Drainage Baseline Study for Hamilton Army Airfield* (Bissell & Karn/Greiner 1993)
- *Perimeter Drainage Ditch Engineering Evaluation Report*, *BRAC Property Hamilton Army Airfield* (U.S. Army Corps of Engineers 1997)
- Hydrologic Analyses by Philip Williams & Associates, prepared in 1998 as supporting documentation for the Draft Hamilton Wetlands Conceptual Restoration Plan

The evaluation of flood zoning and drainage easements is based on the evaluation of hydrology and the language of the existing easements and flood zoning, which are summarized in appendix of this document.

Information presented in the tidal hydraulics section is based on the following sources.

- *Suspended Particle Transport and Circulation in San Francisco Bay: An Overview, in Estuarine Processes—Volume II* (Conomos and Peterson 1977)
- *Wind in California* (California Department of Water Resources 1978)
- *Sacramento–San Joaquin Delta Atlas* (California Department of Water Resources 1993)
- *Sediment Budget Study for San Francisco Bay* (U.S. Army Corps of Engineers 1992)
- Review of Model Plans for the John F. Baldwin Ship Channel Project (U.S. Army Corps of Engineers 1996c)
- Tidal benchmark data (Tide Gage 941-5252)

Topography

The BMKV site consists of former tidal marshlands that were historically diked and isolated from tidal action to permit agricultural use. Topographic relief in the area is low and gradients are gentle. A regional location map that indicates the location of the major surface-water and tidal channels in the vicinity of the BMKV site is shown in figure 4-2. Ground-surface elevations in the area are now as much as 6 feet below mean tide level (MTL). Subsidence has likely been an indirect result of diking for agricultural use. In the absence of natural tidal action, the shallow sediment column is no longer saturated; consequently, organic matter oxidizes and is reduced in volume, leading to settlement.

Perimeter levees separate the BMKV site from San Pablo Bay, Novato Creek, the BMK lagoon, Pacheco Pond, and the HAAF site. Table 4-1 shows levee-top elevations.

Table 4-1. Elevations of Levees Adjacent to BMKV Expansion Site

Levee Location	Approximate Levee-Top Elevation (Feet NGVD 29)
BMKV Site/San Pablo Bay	6–10
BMKV Site/Novato Creek	5–8
BMKV Site/BMK Lagoon	2-5
BMKV Site/Pacheco Pond	8–11
BMKV Site/HAAF Berm	1–5

A gap is present at the eastern end of the levee segment that separates the BMKV site from the HAAF site. The levee grade in that area has been lowered almost to the surrounding site grade.

Climate

The expansion site and the surrounding area are characterized by a Mediterranean climate with warm, dry summers and cool, wet winters (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998). The climate is strongly influenced by conditions in San Francisco Bay and, to a lesser extent, the Pacific Ocean. July is typically the warmest month, with a mean daytime temperature of approximately 80° F. January is the coldest month, with a mean daytime temperature of approximately 54° F. Differences in minimum and maximum daily temperatures are approximately 30° F in the summer months and 15 to 20° F in the winter (U.S. Army Corps of Engineers 1987).

Precipitation near the expansion site ranges from approximately 22 to 30 inches per year, with 90% falling between the months of November and April (U.S. Army Corps of Engineers 1987), primarily in the form of rain. Even in the upper watersheds snowfall is rare, and snowmelt does not contribute significantly to runoff (Jones & Stokes 2001).

Wind-direction frequency plots show a uniform directional distribution. The highest mean wind speeds originate from the northwest (10.4 miles per hour [mph]) and southeast (8.8 mph) (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998).

Surface-Water Drainage Patterns

The expansion site is located in a watershed bounded by the hills of central and northern Marin County (a portion of the California Coast Ranges) to the west and San Pablo Bay to the east (figure 4-2). The upland areas have elevations of 1300–1600 feet NGVD 29 and support mixed open grasslands, oak woodlands,

and chaparral (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998). The lowlands have elevations as low as several feet below MTL and consist of agricultural fields that were reclaimed from the Bay by levees in the late 1800s.

In the San Francisco Bay region, the permeability of both soils and underlying bedrock is typically low. As a result, infiltration rates are slow, runoff rates are correspondingly high and strongly dependent on precipitation, and base flow is poorly sustained. Most streams are ephemeral (Jones & Stokes 2001).

Figure 4-2 shows the major surface-water drainage features on and near the expansion site. They are described in the following sections.

Pacheco Creek

Pacheco Creek drains a watershed of approximately 1.9 square miles. It originates 3 miles west of the HAAF site on Big Rock Ridge; crosses several roadways, including U.S. Highway 101, via culverts; and discharges into Pacheco Pond (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998). Hydrologic studies completed for the Hamilton Airfield Wetland Restoration Plan estimated the 10- and 100-year discharges entering Pacheco Pond at 582 and 1,041 cubic feet per second (cfs), respectively (Philip Williams & Associates 1998).

The lower reach of Pacheco Creek is defined as the region downstream of the Northwest Pacific Railroad Bridge crossing. In this reach, overtopping due to downstream backwater effects is known to occur for flows smaller than the 10-year event (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998, Philip Williams & Associates 1998). When flooding occurs, overflow also affects the Las Robles mobile home area adjacent to the business park (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998). Overflow was formerly directed toward Landfill 26 and back to Pacheco Pond over the Ammo Hill saddle (Philip Williams & Associates 1998). The U.S. Army constructed a berm around a portion of Landfill 26, the purpose of which is to protect the landfill from overflow from Pacheco Creek up to the level of the 100-year flood event (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998).

Arroyo San Jose

Arroyo San Jose drains a watershed of approximately 5.4 square miles. Like Pacheco Creek, Arroyo San Jose has its headwaters on Big Rock Ridge and discharges into Pacheco Pond. The 10- and 100-year discharges are 1,369 and 2,455 cfs, respectively (Philip Williams & Associates 1998). Arroyo San Jose accounts for approximately 75% of the inflow to Pacheco Pond (Philip Williams & Associates 1998).

Arroyo San Jose is expected to remain within its banks during floods as large as the 100-year event, with the exception of the lower reaches where high stages in Pacheco Pond can cause overtopping due to backwater effects (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998).

Pacheco Pond

Pacheco Pond, also known as Ignacio Reservoir, was constructed by the developer of the Ignacio Business Park and deeded to MCFCWCD as a detention basin for flows from Pacheco Creek and Arroyo San Jose. It also provides freshwater wetland and wildlife habitat. MCFCWCD and DFG jointly manage Pacheco Pond.

Pacheco Pond covers an area of approximately 120 acres and has an estimated flood storage volume of 866 acre-feet between an elevation of 0 and 7 feet NGVD 29. This volume was estimated by use of topographic data derived from a Light Detection and Ranging (LIDAR) survey conducted in 2000 (Jones & Stokes 2001). Pacheco Pond discharges into Novato Creek via a leveed channel with an invert elevation of –0.86 feet NGVD 29, controlled by six 4-foot-by-4-foot flap gates. These gates are also known as the Leveroni tidegates.

Two 24-inch siphons were installed by the U.S. Air Force to provide an overflow from the pond reservoir onto the HAAF parcel. The siphons were designed to prevent overtopping and damage to the airfield levee, but they are no longer operational (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998).

Water surface elevations in Pacheco Pond can be controlled by a sill at the upstream face of the Bel Marin Keys Boulevard culvert. The minimum pond elevation can be raised by inserting flashboards on the upstream side of the culvert. An operating agreement between MCFCWCD and DFG establishes the desired water-surface elevation in the pond water at 1.5 feet above mean sea level (MSL). The minimum pond water surface elevation is equivalent to the sill elevation of the culvert (approximately –0.86 feet NGVD 29). Flashboards were not in place during a site inspection completed in January 2002. At the time of the inspection, inflow to Pacheco Pond from Arroyo San Jose and Pacheco Creek was minimal, and the water-surface elevation in the pond was measured at approximately 0 feet NGVD 29 in January 2002 (Northwest Hydraulic Consultants 2002).

During high-flow events, the water level in Pacheco Pond may exceed the elevation of adjacent levees. The lowest point in the levees (elevation 5.6 feet NGVD 29) is north of the pond, adjacent to the Leveroni property. Overtopping has also been observed near the confluence of the outflow channel with Novato Creek, on the west side of the pond near Ignacio Business Park, and further upstream at the Las Robles mobile home park (Philip Williams & Associates

1998; California State Coastal Conservancy and U.S. Army Corps of Engineers 1998).

Novato Creek

Novato Creek is the principal drainage in the vicinity of the expansion site and has an approximate total watershed area of 44 square miles (U.S. Army Corps of Engineers 1987). The Corps has computed 10- and 100-year discharges near the Highway 101 crossing at 3,420 cfs and 6,230 cfs, respectively (U.S. Army Corps of Engineers 1987), and recognizes an "ultimate flow" of 8,000 cfs at the mouth of Novato Creek. However, the railroad bridges downstream of Highway 101 and adjacent to Highway 37 constrict flow, causing overtopping upstream of the lowest reach of Novato Creek and reducing the actual discharge in the lower reaches of the creek. The 8,000-cfs value in particular is unlikely to pertain to the reaches of Novato Creek adjacent to the BMKV site (CSW/Stuber-Stroeh Engineering Group 1996).

Recent modeling efforts have shown that the tidal influence extends upstream of Highway 101 to the City of Novato during flows greater than the 10-year event (Philip Williams & Associates 1998). During storm periods, the maximum water surface elevation observed at the Highway 37 crossing was approximately 7 feet NGVD 29 (Philip Williams & Associates 1998).

Top-of-levee surveys completed in 1996 indicate that the levee crest between Novato Creek and the BMKV site dips to an elevation of approximately 5.6 feet, NGVD 29, at a point approximately 1000 feet downstream from the BMK south lagoon navigation lock (Jones & Stokes 1996). Overtopping of this levee was observed by BMK residents in the February 1998 flood event.

Bel Marin Keys Development

The BMK development is located adjacent to the northwest boundary of the expansion site. BMK is a waterfront residential community with 2 internal constructed lagoons that offer access to Novato Creek though a system of locks. The BMK community uses Novato Creek for boat access to San Pablo Bay and relies on tidal changes in water level to periodically exchange flow between the BMK lagoons and San Pablo Bay. Storm drainage to the lagoons is aggravated by coincident high Novato Creek stages, caused either by high San Pablo Bay tides or high Novato Creek discharge, with high amounts of local precipitation over the BMK development.

Water level is managed at 2 feet NGVD 29 in the north lagoon and 0.5–1 foot NGVD 29 in the south lagoon (CSW/Stuber-Stroeh Engineering 1996). Stormwater is discharged to Novato Creek via the boat access lock. Discharge into Novato Creek is limited by stage in the creek; during high-flow periods,

runoff is impounded in the lagoons until flow recedes (CSW/Stuber-Stroeh Engineering 1996).

Stormwater from the south lagoon can also be discharged onto BMKV via culverts in the levee on the eastern edge of the south lagoon. In 1997, the former owner of the BMKV property granted the BMK Community Services District (CSD) the right to construct, maintain, and repair an emergency spillway on the existing levee, the purpose of which is to relieve high water in the lagoon surrounding Units III and IV of the BMK subdivision. This agreement also granted the right to discharge water onto a 3-acre portion of the BMKV property from the lagoon when the lagoon and Novato Creek reach a level of 1.5 feet NGVD (see appendix E). At present, the conveyance structure for flow from the BMKV south lagoon to the adjacent part of the BMKV property consists of a weir and three 12-inch culverts. The low point on the BMKV south lagoon/BMKV levee is approximately 2 feet NGVD, so it is also possible for flow to overtop the south lagoon levee and flow onto BMKV.

Hamilton Army Airfield

The former HAAF property is located south of the BMKV site. The HAAF site receives flood overflows from Pacheco Creek via 48- and 24-inch flap gates that serve the Landfill 26, Ammo Hill, and POL Hill areas. However, prior to 1999, the Army completed construction of a berm around a portion of Landfill 26 to protect the landfill from overflow from Pacheco Creek up to the 100-year flood. (HAAF BRAC Environmental Office 2001) Historically, HAAF also received overflows from Pacheco Pond via 2 slide-gated siphons. These siphons are no longer operational (Philip Williams & Associates 1998). Flood overflows also enter the HAAF site from the BMKV parcel through a levee gap approximately 2,000 feet southeast of the HAAF site's northwest corner.

Conceptual design for the HAAF tidal wetland restoration feasibility study (U.S. Army Corps of Engineers 1998) suggested that the connection between HAAF and Pacheco Pond may change. The specific design of any modified drainage between Pacheco Pond and HAAF has not been determined at this time. No modifications to the connection between Pacheco Pond and HAAF are proposed as part of the BMKV expansion.

Tides

Tides in San Pablo Bay follow a mixed semidiurnal cycle, with 2 high tides of unequal elevation and 2 low tides of unequal elevation per day. Average high tide elevation values are referred to as mean higher high water (MHHW) and mean high water (MHW). Similarly, low tide peaks are referred to as mean low water (MLW) and mean lower low water (MLLW). Events such as storm high tides that exceed the elevation of MHHW are referred to as extreme high tide (EHT).

Because of geographic and hydrodynamic complexities, tidal characteristics, including the elevations of average high, low, and mean tides, differ substantially throughout the San Francisco Bay–San Pablo Bay system. Tide cycles in San Pablo Bay typically lag behind those at the Golden Gate by as much as 75 minutes (U.S. Army Corps of Engineers 1996). However, within San Pablo Bay itself, comparison of tide levels within Novato Creek and at the mouth of the Petaluma River indicates that the lag time is negligible between these sites (Philip Williams & Associates 1998).

Table 4-2 shows statistical tidal information for the expansion site, obtained from measurements made by the National Oceanic & Atmospheric Administration/National Ocean Survey (NOAA/NOS) at the mouth of the Petaluma River (Tide Gage #941 5252) (NOAA/NOS 1981). Table 4-2 also shows the expected elevation of a 100-year tide in San Pablo Bay. The 100-year tide represents a tide that has a 1-in-100 (or 1%) chance of occurring in any given year.

Table 4-2. Tide Information from the Petaluma River Entrance

Tide Level	Feet above MLLW Datum	Feet above NGVD 29 Datum
100-Year Event (SF COE)[1]	9.63	6.50
MHHW[2]	6.06	3.43
MHW[2]	5.49	2.86
MTL[2]	3.24	0.61
NGVD 1929[2]	2.63	0.00
MLW[2]	1.00	-1.63
MLLW[2]	0.00	-2.63

Sources:
[1] NOAA/NOS 1981
[2] U.S. Army Corps of Engineers 1984

Tide data recently collected by San Francisco International Airport's Airfield Development Engineering Consultant (ADEC) (2000) at the mouth of the Petaluma River correspond closely to the NOAA/NOS data shown in table 4-2. The ADEC data consist of water surface measurements taken at 10-minute intervals over a 30-day period from June 15, 2001 to July 15, 2001. The MHW computed from the ADEC data is 0.14 foot below the value reported by NOAA; the MLW computed from the ADEC data is 0.07 foot above the value reported by NOAA.

Sediment Budget

The sediment budget in the San Francisco Bay–San Pablo Bay system is a key factor in restoration design because the design development process relies on natural delivery of sediment to transform the framework created by restoration construction into a functioning, mature marshland over time. The fine-sediment fraction (suspended load and fine bed load) is particularly important because it provides the primary sedimentary building blocks for naturally evolving tidal marsh regimes. The following sections provide additional information on sediment loading in the Bay system, with a focus on the fine (suspended load) fraction.

Overview of Suspended-Sediment Loading in the San Francisco Bay Estuary

Like salinity, suspended-sediment concentration is controlled by a balance of factors. Important influences on suspended-sediment loading include wind speed and direction (i.e., the magnitude of wind-driven waves and strength of wave currents), freshwater influx, and tidal currents (Northwest Hydraulic Consultants 2001). Freshwater influx shows a strong seasonal variation, with a peak during the winter (November–April) rainy season; land-derived sediment loading shows a corresponding peak in the winter. Tidal currents vary on a semi-monthly basis from neap tides to spring tides, with the greatest sediment mobility at spring tides.

Throughout the year, suspended-sediment concentrations are generally highest in the North Bay region and at the southern end of the Bay. USGS data show average concentrations of approximately 80–150 milligram/liter (mg/l) in San Pablo Bay for water years 1997 and 1998. Sediment concentrations are typically lower in the central portion of the Bay (Northwest Hydraulic Consultants 2001).

Many of the North Bay's sloughs are fed by relatively small creeks. Measured sediment concentrations in these sloughs range from 41 to 386 mg/l and typically decrease with increasing distance from San Pablo Bay (Warner and Schoellhammer 1999, Buchanan and Ruhl 2000) because the Bay is their primary source of sediment. By contrast, the larger Petaluma River system carries a substantial suspended-sediment load because of its larger watershed. As a result, sedimentation rates at locations on the margin of San Pablo Bay near the river mouth (e.g., Bel Marin Keys, Port Sonoma Marina, and Petaluma Marsh) are as much as 0.5–1.3 feet per year (U.S. Army Corps of Engineers 1998).

Flood Overlay Zoning

The Marin County Zoning map currently designates an 8-acre portion of the BMKV site along Novato Creek as an F-1 (primary floodway) overlay zone, with

the remainder of the site designated as an F-2 (secondary floodway) overlay zone (see figure 4-3). A large portion of the surrounding areas in the lower Novato Creek watershed are also designated F-2 (see figure 4-4).

The F-1-designated zone is north of the northern levee of the site and on a small area in the northwestern corner of the site that faces Novato Creek. The purpose of the F-1 zone is to protect life and property within the designated zone and to prevent random, uncontrolled development from impeding passage of floodwaters and increasing flooding. No dredging, filling, or levee or dike construction is permitted within F-1 zones if it would increase the water-surface level or impede the flow of water within the zone.

The F-2-designated zone covers the remainder of the BMKV site. The purpose of the F-2 zone is to protect life and property and to prevent random, uncontrolled development from increasing flooding by decreasing the capacity of secondary floodplains to receive overflow floodwaters. No buildings, dredging, filling, or levee or dike construction is permitted within F-2 zones if it would reduce or eliminate the ponding capacity of the land within the F-2 zone by more than 25%. If the ultimate flood control channel improvements (described below) were made to Novato Creek, as defined by the MCFCWCD, or if an alternate method of providing flood control facilities for the zone, equal in capacity to the ultimate channel improvements, was established, then full use of the site would be allowed. The ultimate channel improvements consist of constructing a specified channel along Novato Creek from Highway 101 to San Pablo Bay that is designed to contain approximate 100-year flood events within the channel.

Drainage Agreements and Easements

The BMKV site is subject to 3 drainage agreements and easements relevant to the expansion (see figure 4-4).

The BMK Unit IV development is an approximately 100-acre area located in the southwest portion of the larger BMK residential development area. To facilitate the development of BMK Unit IV within the F-2 zone, a drainage agreement was recorded in 1980 that allowed the development of BMK IV to proceed, provided that a 300-acre area (Area 1 on figure 4-4) was preserved for flood protection purposes on BMKV. The agreement was between the former owner of the BMKV property and MCFCWCD, and specified that the owner of the 300-acre area on BMKV could not fill or otherwise prevent flood-water ponding and could not use the area in a manner that would cause additional flooding to other properties in the vicinity. Provisions of this agreement remain in full force until Novato Creek ultimate channel improvements occur or equivalent measures are implemented.

A second drainage agreement was established in 1986 to facilitate the placement of dredged materials by BMK CSD on several fallow fields in the northeast corner of BMKV (Area 2 on figure 4-4). This agreement was between BMK

CSD, MCFCWCD, and the owner of the BMKV parcel, and required the owner of BMKV to maintain a 70.2-acre area (Area 3 on figure 4-4) for ponding purposes to compensate for the loss of ponding capacity in the dredged material placement area. Other areas can substitute for Area 3 if the replacement ponding area has a ponding volume as great or greater than that of Area 3; the substitution ponding area won't flood other property in the area; and MCFCWCD agrees. The agreement conditions can also be lifted if the owner moves all or part of the dredged material fill to another location, which would release the obligation to retain Area 3 for flood-water ponding as long as the owner provided an engineered plan that is satisfactory to MCFCWCD. Provision of this second agreement remains in force until the Novato Creek ultimate channel improvements occur, equivalent storage is provided, or all government agencies have issued permits for the development of parcels adjacent to the dredged material area and Area 3.

In 1997, the owner of the BMKV property provided an easement to BMK CSD to construct, maintain, and repair an emergency spillway on the south lagoon levee (location 4 on figure 4-4). The purpose of this emergency spillway is to relieve high water in the south lagoon surrounding the BMK subdivision. The easement also granted the right to discharge overflow water from the south lagoon to a 3-acre portion of BMKV, when the lagoon and Novato Creek reach a level of 1.5 NGVD. The easement provides for removal of the easement if a project on the BMKV property includes flood control measures, such as levees of sufficient height, to contain the high water in the lagoons surrounding Units III and IV of the BMK subdivision.

Environmental Consequences and Mitigation Measures

Approach and Methods

Hydrologic resources and surface-water drainage patterns in the expansion area have been documented extensively in previous work (Northwest Hydraulic Consultants 2002, U.S. Army Corps of Engineers 1989 and 1997, Bissell & Karn/Greiner 1993, unpublished U.S. Army Corps of Engineers data, Woodward-Clyde 1998, and associated background information). The potential environmental consequences of the restoration alternatives on hydrological resources have been evaluated primarily through review and analysis of available information. Based on an understanding of present hydrologic conditions, the potential impact mechanisms were identified. Potential impacts were then identified based on these impact mechanisms, and additional technical analysis was conducted where required to quantify or mitigate impacts associated with the proposed BMKV expansion.

To assess the impacts of tidal wetland restoration on the hydrology of the site, Northwest Hydraulics Consultants completed hydrologic and hydraulic modeling

studies that assessed the effects of proposed expansion activities, such as Pacheco Pond and tidal wetland modifications, on flooding conditions along Novato Creek and Pacheco Pond. These studies were based on a review of hydrological studies of the Novato Creek and Pacheco Pond watersheds. Existing and potential future site conditions that affect the drainage and flooding characteristics were identified. Representative flood hydrographs and tidal stage characteristics were determined and used for computing flood stage and discharge conditions in the study area. To quantify the changes in flood stage and discharge magnitude resulting from coincident terrestrial and tidal flood conditions, a one-dimensional, unsteady flow model of the Novato Creek and Pacheco Pond system was developed. The modeling approach and results are discussed in greater detail in appendix B.

Potential impacts on the tidal hydraulic regime and morphology of San Pablo Bay and its environs were determined by comparing the magnitude of the relevant tidal hydraulic parameters under existing conditions with the expected magnitude of the tidal hydraulic parameters after implementation of the various restoration alternatives.

Effects of the proposed BMKV expansion on flood overlay zoning and existing drainage agreements are also discussed separately in this section.

Impacts to hydrology are identified as Impact HYD-X; impacts to tidal hydraulics are identified as Impact TH-X.

Impact mechanisms

Hydrology

The following types of activities and processes associated with implementation of the restoration alternatives could result in changes in flooding and surface-water drainage in the vicinity of the expansion area.

Conversion of Existing Diked Agricultural Fields to Tidal Marsh

The restoration alternatives would convert existing leveed lowlands in the expansion area to tidal wetland. The restored tidal wetland area would be subject to the tidal elevations characteristic of San Pablo Bay. Outboard levees along San Pablo Bay and Novato Creek would be breached and/or lowered to facilitate tidal wetland creation and tidal flows. The impact mechanisms for the proposed BMKV expansion include the effects of placing fill on existing drainage facilities for adjacent property and the effects of opening formerly diked areas to tidal flow.

Modification of Pacheco Pond and Pacheco Pond Outlet Facilities

The restoration alternatives would enlarge the dimensions of Pacheco Pond and/or provide for overflow of the pond to a seasonal wetland area. A new pond outlet would be constructed to allow discharge from Pacheco Pond to flow to

either the tidal marsh restoration area (Alternatives 1 and 3) or the seasonal marsh restoration area (Alternative 2) through a conveyance structure, such as a flap-gated culvert or a weir. The impact mechanisms for the proposed BMKV expansion include the effects on altered flood-storage characteristics of Pacheco Pond and changes in pond drainage conditions no longer influenced by water surface stage conditions within Novato Creek.

Pacheco Pond is owned by MCFCWCD and is operated under a joint agreement between CDFG and MCFCWCD (Marin County Flood Control and Water Conservation District and California Department of Fish and Game 1980). As described in chapter 3, as part of the BMKV expansion, the Corps, Conservancy or their successors, in cooperation with MCFCWCD and CDFG, would develop a modified water management plan for Pacheco Pond to continue the purposes of flood control and wildlife habitat conservation for which the pond was built. Potential diversion of some or all of the discharge from Pacheco Pond would change flow and stage conditions within Novato Creek. Responsibilities for maintenance of the Pacheco Pond facilities and outlet structures would be determined as part of the development of a new water management plan.

Tidal Hydraulics

The following types of activities and processes associated with implementation of the restoration alternatives could result in changes in tidal hydraulic circulation or morphologic processes in Novato Creek, San Pablo Bay, or the restored tidal wetlands in the expansion area.

Tidal and Residual Circulation in San Pablo Bay

Creation of an additional tidal prism on the western shoreline of San Pablo Bay would induce tidal currents into and out of the tidal prism of the restored tidal wetland. This action could alter circulation patterns within San Pablo Bay.

Morphology of San Pablo Bay Shoreline and Novato Creek

The proposed BMKV expansion would involve construction of tidal outlet channels through the existing outboard salt marsh and mudflats. Additional morphologic adjustments and changes within San Pablo Bay and Novato Creek could develop over time.

San Pablo Bay Sediment Budget

The proposed BMKV expansion is designed to trap suspended sediment from San Pablo Bay and Novato Creek. Sediment deposition within the restored wetlands may affect the overall sediment budget and existing sediment deposition patterns within San Pablo Bay.

Tidal and Residual Circulation in Restored Tidal Wetlands

The proposed BMKV expansion would create tidal circulation and inundation on properties that are presently protected by levees and drained by the existing HAAF pump stations and perimeter drainage ditch.

Internal Peninsulas and Perimeter Levees

The proposed BMKV expansion would create tidal currents adjacent to the internal peninsulas and the expansion site perimeter levee. Tidal inundation would allow for wind-wave action on these structures that could induce erosion or morphologic change over time.

Thresholds of Significance

The following significance criteria were used to evaluate the proposed BMKV expansion. Regarding surface hydrology, the proposed expansion was identified as resulting in a significant impact on the environment if it would

- substantially alter drainage patterns, flow rates, or volumes;
- increase the risk of flood peaks or volumes that would damage infrastructure or property or endanger public safety;
- result in hydrologic changes that could adversely affect existing or planned biological communities;
- result in the need for new drainage facilities and capital expenditures; or
- increase the potential for erosion or sediment deposition.

Regarding tidal hydraulics, the proposed expansion was identified as resulting in a significant impacts on the environment if it would

- alter the magnitude and direction of tidal circulation outside the immediate zone of subtidal and outboard marsh channels constructed for the project;
- alter the large-scale morphology of mudflats and subtidal channels outside the immediate zone of subtidal and outboard marsh channels constructed for the project;
- cause erosion of the perimeter levees, thus increasing the risk of tidal flooding on adjacent properties;
- induce or aggravate erosion of the existing outboard salt marsh;
- cause insufficient sediment deposition within the tidal marsh to develop morphologically as proposed; or
- cause long-term persistence of internal peninsulas.

In addition to these criteria, the consistency of the restoration alternatives and existing flood zoning designations and drainage agreements were considered when evaluating the significance of potential project effects on hydrology.

Impacts and Mitigation Measures of No-Action Alternative

Maintaining the BMKV parcel in its present condition would result in no impacts on the surface-water hydrology of San Pablo Bay and Novato Creek. The Conservancy would continue to maintain the property in caretaker status. Operation and maintenance of Pacheco Pond and its appurtenances and the interior drainage system of the BMKV site would continue. The existing surface-water drainage characteristics of Pacheco Pond, Novato Creek, the BMK community, and the BMKV site would be unaffected.

Maintaining the BMKV site in its present condition would result in no impacts on the tidal hydraulic environments of San Pablo Bay and Novato Creek. The existing outboard tidal marshes, mudflats, and subtidal channels of San Pablo Bay would be unaffected.

Impacts and Mitigation Measures Common to Alternatives 1–3

Impact HYD-1: Potential for Change in Peak Stage in Pacheco Pond

As part of the restoration alternatives, the physical dimensions of Pacheco Pond would be enlarged and provide additional storage capacity of the Pond. The restoration alternatives also entail the construction of a new connection between Pacheco Pond and the BMKV site, and the potential diversion of some or all flow from the existing outlet of Pacheco Pond to Novato Creek to the BMKV site. Diverting the flow to BMKV would reduce Pacheco Pond stages during flood events by eliminating constraints on existing Pacheco Pond drainage imposed by high Novato Creek stages that occur during coincident flooding events. High Novato Creek stages control Pacheco Pond flap-gate (also known as the Leveroni tidegate) operations under existing conditions, limiting the duration and magnitude of discharges from the gates. Under Alternatives 1 and 3, the enlarged Pacheco Pond would be directly connected to the restored tidal marsh and San Pablo Bay. Therefore, operation of the new flap gates would be constrained only by San Pablo Bay tide stage and not by coincident Novato Creek and tidal flooding conditions. Alternative 2 proposes an overflow weir connection between Pacheco Pond and a seasonal wetland basin. The seasonal wetland basin would provide additional flood storage capacity for the Pacheco Pond system and ultimately discharge directly to the restored tidal marsh and San Pablo Bay.

Under Alternatives 1 and 3, Pacheco Pond would be expanded to a capacity of approximately 1,241 acre-ft (above 0-ft, NGVD 29), with flow diverted to restored tidal marsh through a flap-gated culvert structure hydraulically identical to the existing one at Novato Creek. This would be an increase of 375 acre-ft

above existing capacity. Under Alternative 2, Pacheco Pond would be expanded through the addition of a seasonal wetland constructed adjacent to the existing pond, with a storage volume of approximately 1,155 acre-ft (above 0-ft, NGVD 29). This would be an increase of 259 acre-ft above existing capacity.

The hydrologic conditions considered in the analysis of the restoration alternatives consisted of 2 scenarios. These scenarios, referred to here as Scenario A and Scenario B, are based on available data and are meant to approximate the 10- and 100-year storm events for existing conditions, respectively. However, a comprehensive statistical evaluation of precipitation, watershed conditions, and runoff was not performed to identify the inputs for these scenarios. The results of the modeling for Pacheco Pond elevations are presented below in table 4-3 and discussed in greater detail in appendix B.

Table 4-3. Peak Water Surface Elevations in Pacheco Pond (feet NGVD 29)

Case	Scenario A	Scenario B
Existing	6.4	7.6
Alternative 1 & 3	4.5	7.2
Alternative 2	4.6	6.3

Reducing flood stage within Pacheco Pond would reduce water-surface elevations in the lowermost reaches of both Pacheco Creek and Arroyo San Jose, which would enhance surface-water drainage characteristics within the Ignacio Business Park. Since the proposed BMKV expansion would reduce the risk of flooding in Pacheco Pond and the Ignacio Business Park, this impact is considered beneficial.

Impact HYD-2: Potential Change in Pacheco Pond Peak Drainage

The restoration alternatives propose to increase the storage capacity of Pacheco Pond and redirect some or all of the outlet flows of the pond through a flap-gated culvert to the restored tidal marsh (or seasonal marsh in Alternative 2) and San Pablo Bay, thereby eliminating potential constraints on pond drainage imposed by high stages within Novato Creek. These modifications would result in reduced stages within Pacheco Pond for all combinations of Novato Creek, Pacheco Pond watershed, and tidal flooding conditions assessed in the conceptual restoration design. Since Pacheco Pond stages would be reduced during flooding events for all restoration alternatives, this impact is considered beneficial.

Impact HYD-3: Potential Change in Pacheco Pond Overflows into the Leveroni Property

The restoration alternatives propose to increase the storage capacity of Pacheco Pond and redirect some or all of the outlet flows of the pond to the restored tidal marsh (or seasonal marsh in Alternative 2) and San Pablo Bay through a flap-gated culvert, thereby eliminating any potential constraints on pond drainage imposed by high stages within Novato Creek. These modifications would result in reduced stages within Pacheco Pond for all combinations of Novato Creek, Pacheco Pond watershed, and tidal flooding conditions assessed in the conceptual restoration design. They would also result in reduced frequency of overtopping events of the existing Leveroni Property levee for all restoration alternatives. This impact is considered beneficial.

Impact HYD-4: Potential Increases in Novato Creek Flood Stage

The restoration alternatives would redirect some or all of the Pacheco Pond outlet flows from Novato Creek to a flap-gated culvert that flows directly to the restored tidal wetland (or seasonal wetland in Alternative 2) and San Pablo Bay. This modification would reduce flows into the lower reach of Novato Creek, reducing flood stage in Novato Creek during coincident Pacheco Pond and Novato Creek flood events.

To examine the effect of this diversion, stage hydrographs at select locations along Novato Creek are presented in figures 4-5 and 4-6, for scenarios A and B, respectively. The locations chosen include the upstream limit of the model at Highway 37 bridge (CS 10), at the existing confluence of Pacheco Pond with Novato Creek (CS 8), and just downstream of the lower BMK navigational lock (CS 4).

The stage hydrographs shown in these figures suggest that peak water-surface elevations within Novato Creek are controlled primarily by tidal fluctuations. That is, the effects of diverting Pacheco Pond flow, in addition to the added tidal prism created by the constructed tidal marsh, would not substantially change the peak water-surface elevations between existing and future constructed conditions. The changes that would occur are a negligible drop (less than 0.1 foot) in peak stage when Pacheco Pond flow is diverted. While peak stages in Novato Creek would not be substantially altered, certain portions of the sub-peak stage (essentially lower portions of the tide cycle) would be lower with the implementation of any of the alternatives.

Since the restoration alternatives would provide for a reduction in flood stage within Novato Creek, albeit minimal, this impact is considered beneficial.

Impact HYD-5: Potential Change in Drainage Capacity from the Bel Marin Keys Lagoons

BMK lagoons presently drain through the existing lock and culvert structures to Novato Creek, when creek stage permits drainage. The lagoons also fill from Novato Creek through these same structures. The BMK south lagoon can also overflow through a culvert structure into the BMKV site. As part of the restoration design, some or all of the outlet flows from Pacheco Pond would no longer discharge into Novato Creek. This modification would reduce flood stage in Novato Creek and enhance the opportunity for lagoon drainage to Novato Creek. In addition, Alternatives 1 and 2 include improving the existing south lagoon overflow culverts and providing for this overflow into a seasonal wetland drainage swale and improved drainage to Novato Creek. Alternative 3 provides for new lagoon pumping facilities to drain the south lagoon during periods of high lagoon stage.

None of the alternatives involve modifications to the normal lagoon operations, such as flushing events, nor do they increase inflow into the lagoons during normal or high stage flow. Therefore, the alternatives are not expected to result in increased sedimentation of the lagoons themselves. The lagoons are filled with tidal flow from Novato Creek and the Pacheco Pond outflow provides little to the baseflow of Novato Creek, except under storm conditions. Thus, the redirection of some or all of the Pacheco Pond outflow is not expected to significantly effect the ability to flush the BMK lagoons. Since the restoration alternatives would overall result in improvements to drainage conditions from the BMK lagoons, this impact is considered beneficial.

Impact HYD-6: Potential Increases in Tidal Flooding

All of the restoration alternatives would breach and lower the outboard levee between BMKV and the San Pablo Bay, thereby opening the site to tidal inundation and potential tidal flooding. Alternatives 1 and 2 would also breach the Novato Creek/BMKV levee. These actions could expose the existing BMK south lagoon and the Pacheco Pond levees to tidal action. All restoration alternatives include an upland transition berm and levee structure that would be constructed to an elevation above the 100-year tidal flood elevation, with an allowance for settling and freeboard. Since this feature would not increase the potential for tidal flooding and incorporates design features for levees that would be newly exposed to tidal flows, this impact is considered less than significant.

Impact HYD-7: Potential Inconsistency with Flood Zoning

Based on the hydrologic and hydraulic analysis conducted for the BMKV expansion, the restoration alternatives are not expected to result in an adverse physical effect on flooding related to Novato Creek, Pacheco Pond, or adjacent properties, such as the BMK community. A second hydrologic and hydraulic

study that encompasses a larger study area and an expanded number of parameters and scenarios is being conducted at the request of MCFCWCD. It is expected that this second study will confirm the results of the first study.

The purpose of the F-1 zone is to protect life and property within the designated zone and to prevent random, uncontrolled development from impeding passage of floodwaters within the zone and increasing flooding. All of the restoration alternatives include removal of the levee that separates the BMKV site from Novato Creek, which would enhance passage of floodwaters from Novato Creek to San Pablo Bay by increasing the width of the flood channel along the perimeter of the BMKV site. None of the alternatives includes any filling or placement of structures within the F-1 zone, and thus the project overall appears to be consistent with the F-1 zoning requirements. However, MCFCWCD is the responsible agency for determining the applicability and consistency of proposed actions related to the county flood zoning ordinances, and a determination of consistency with the F-1 zoning requirements has not been made by MCFCWCD as of this draft SEIR/EIS.

The F-2 zone covers the remainder of the BMKV site. The purpose of the F-2 zone is to protect life and property and prevent increased flooding caused by random, uncontrolled development that would decrease the capacity of secondary floodplains to receive overflow floodwaters. As described above, the wetland restoration alternatives are protective of life and property, provide a net reduction in localized flood risk around Pacheco Pond, do not result in an increase of flood stage in Novato Creek, and do not impede passage of floodwaters.

The restoration alternatives include placement of fill in the form of dredged material, levee construction, and natural sedimentation. The restoration alternatives do not include any specific design features to replicate the ultimate channel or its equivalent. However, as noted above, the restoration alternatives are expected to lower relative stage in Pacheco Pond and are not expected to cause an increase in stage in Novato Creek.

The Corps, Conservancy, MCFCWCD, and Marin County are currently establishing a process to resolve the flood zoning. If the results of the first study are confirmed by the second study (which is expected), MCFCWCD may determine that the restoration alternatives comply with the flood zoning ordinance. However, it is also possible that MCFCWCD may determine that the restoration alternatives do not comply with the flood zoning ordinance because of the proposed filling and other activities and the potential lack of an ultimate channel or an alternate method equal in capacity to the ultimate channel.

NEPA and CEQA require an evaluation of whether a physical effect is a significant effect on the environment. The completed hydrologic and hydraulic analysis has not identified an adverse physical effect on flooding. MCFCWCD has not formally determined whether the restoration alternatives are consistent with the requirements of the flood zoning ordinances. Pending that determination and for the purposes of significance determination only, it is

assumed as of this draft SEIR/EIS that the restoration alternatives are not consistent with the F-2 zoning requirements. The Corps and Conservancy, as the CEQA and NEPA lead agencies, considered the conclusions of the completed hydrologic and hydraulic analysis; the physical effects of filling, constructing new levees, breaching/lowering the perimeter levees, diverting some or all of the Pacheco Pond outlet flow; and the potential inconsistency with the F-2 zoning, in addition to the intensity and context of this impact, prior to determining whether a significant effect on the environment related to flooding may occur with implementation of the BMKV expansion. After considering these factors, the lead agencies determined that this is a less-than-significant effect on the environment related to flooding because, although it may later be determined that the project is inconsistent with the local flood zoning ordinance, the project is not expected to result in an increased flood risk to people or property and is expected to result in a minor decrease in flood stage around the perimeter of Pacheco Pond.

The Corps and Conservancy and MCFCWCD are currently establishing a process to resolve the flood zoning. The Corps and Conservancy based on the process determined in concert with MCFCWCD and Marin County, will resolve the flood zoning prior to construction.

Impact HYD-8: Potential Conflict with Existing Drainage Agreements

The 1997 BMK CSD drainage agreement that allows for overflow from the BMK south lagoon would be accommodated by overflow structures under Alternatives 1 and 2 leading to the swale area and by a relief pump under Alternative 3.

The areas of the 1980 and 1987 MCFCWCD drainage agreements would be partially filled under Alternatives 1 and 2 by dredged fill and natural sedimentation and by natural sedimentation under Alternative 3. If it is determined by MCFCWCD that sufficient ponding capacity is retained to replace that of the drainage agreements, the drainage agreements could be amended to reflect the new ponding areas present with restoration. If it is determined that sufficient ponding capacity is not retained, the drainage agreements could still be amended to include the areas of retained capacity.

In order to formalize the dedication of portions of the site to replace the existing drainage agreement ponding areas, the Conservancy, in cooperation with MCFCWCD, would amend the existing 1980 and 1987 drainage agreements to reflect the new ponding areas present with restoration, under any alternative.

Similar to the analysis of significance of flood zoning consistency above, even if it is determined that the preferred alternative is not consistent with the MCFCWCD 1980 and 1987 drainage agreements, this is considered a less-than-significant effect on the environment because the project is not expected to result in increased flood risk to people or property.

The Corps and Conservancy will continue to consult with MCFCWCD concerning resolution of the drainage agreements prior to construction.

Impact TH-1: Modification to Circulation in San Pablo Bay

Tidal fluctuations into and out of the restored tidal wetlands under Alternatives 1, 2, and 3 would generate large tidal currents in and around the perimeter levee breaches. The subtidal channels connecting the basins to the Bay would convey flows of up to 3,000 cfs in areas where no tidal currents exist today. The fluid momentum associated with these flows would be rapidly dissipated along the mud flats as the channels discharge into San Pablo Bay. However, because of the vast size and volume of San Pablo Bay, the general effect of this momentum exchange away from the point of discharge would be insignificant. Thus, large-scale circulation patterns in San Pablo Bay would not be significantly affected by the restoration alternatives, and the impact would be less than significant.

Impact TH-2: Changes in Circulation and Morphologic Evolution in Existing Tidal Wetlands

For the tidal marshes to properly evolve, adequately sized connecting channels would have to be maintained to provide full tidal exchange between the basins and San Pablo Bay. Under-sized connecting channels would reduce the amount of sediment-laden water reaching each basin by creating a hydraulic choke. This could inhibit the morphologic evolution of the wetlands to such a degree that the project objectives might not be achieved, and the loss of biological resources might not be offset by the restoration alternatives. Therefore, this impact to biological resources could be significant. For further discussion and proposed mitigation, see the discussion under the *Biological Resources* section of this chapter.

Impact TH-3: Potential Changes in Lower Novato Creek Morphology due to Diversion of Pacheco Pond Outlet Flows

The restoration alternatives would redirect some or all of the Pacheco Pond outlet flows from Novato Creek to the tidal wetlands and San Pablo Bay through a flap-gated culvert (Alternatives 1 and 3), or to seasonal wetlands on BMKV through a weir and then to San Pablo Bay through a flap-gated culvert (Alternative 2). Daily tidal excursions through Novato Creek are the dominant hydraulic control on the present size and morphology of lower Novato Creek. Hydrologic and hydraulic modeling of restoration alternatives indicate that stage and flow rate in Novato Creek are primarily controlled by Novato Creek flows and San Pablo Bay tidal stage. Pacheco Pond flows can contribute flows to Novato Creek during ebb tidal conditions. These contributions, however, are relatively minor compared to the higher frequency of occurrence and magnitude of flows within

the lower Novato Creek that result from tidally driven flows during spring tide events. Extreme flow events in Novato Creek may induce episodic changes in creek width and depth, although these changes are relatively negligible with respect to the persistent energy imparted by tidal flows. Since the morphology of the subtidal channel of lower Novato Creek is primarily controlled by Novato Creek hydrology and tidal conditions within San Pablo Bay, any small changes in lower Novato Creek morphology due to diversion of some or all of the Pacheco Pond outlet flows are considered less than significant. These changes, as discussed in *Land Use and Utilities* below, are not expected to have a significant effect on the navigability of Novato Creek.

Impact TH-4: Potential Changes in Pacheco Pond Outlet Channel due to Diversion of Outlet Flow

The restoration alternatives would redirect some or all of the flows from the existing Pacheco Pond outlet to Novato Creek to the tidal wetlands and San Pablo Bay through a flap-gated culvert (Alternatives 1 and 3), or to seasonal wetlands on BMKV through a weir and then to San Pablo Bay through a flap-gated culvert (Alternative 2). Depending on the amount and timing of diversion of flows, it is possible that sedimentation may cause the outlet channel between Bel Marin Keys Boulevard and Novato Creek to fill in. The project includes development of an amended water management plan, in cooperation with MCFCWCD and CDFG, to identify options for managing Pacheco Pond wildlife habitat and flood control. The water management plan should be developed in tandem with the engineering design of the restoration project. One possible option is to have dual operation of the two future outlets from the pond (to Novato Creek and to BMKV) to maximize flood control and wildlife habitat benefits, while possibly maintaining flows along the existing outlet channel to Novato Creek to keep the channel open. Another option would be to close the existing outlet at Novato Creek and divert all flows to the restoration site. With implementation of an amended management plan, the impact to circulation within Pacheco Pond itself is expected to be less than significant. However, the potential closing of the existing outlet could result in the loss of open water habitat due to sedimentation. This impact is discussed further in the *Biological Resources* section of this chapter.

Impact TH-5: Outboard Marsh Shoreline Erosion

Tidal circulation between the restored tidal marsh and San Pablo Bay is not expected to induce or aggravate erosion of existing tidal marsh shoreline along San Pablo Bay. However, the proposed BMKV expansion would involve excavation of channels through the existing outboard marsh. Additional erosion of the outboard marsh surface can be expected if the channels widen in response to an increase in tidal exchange. The loss of existing tidal marsh is considered a less-than-significant impact because a primary purpose of the alternatives is the creation of new and additional tidal marsh habitat. The proposed BMKV

expansion is designed to create tidal marsh habitat over and above the amount lost by excavation and erosion of the connecting outboard channels.

Impact TH-6: Excessive or Unexpected Erosion of Perimeter Levees

Perimeter levees adjacent to restoration basins could be subject to increased erosion from current and wave forces. Tidally driven circulation and currents are expected to develop in the basins due to tidal fluctuations, although the velocities are not expected to be high enough to pose a significant erosion risk to adjacent levee structures. Final design studies will be undertaken to investigate and quantify tidal currents in each marsh basin to better assess the risks of localized erosion.

Wind-generated waves pose a more significant erosion risk on perimeter levees than tidal currents. The size of wind-generated waves is primarily a function of the wind speed, wind fetch, wind duration, and water depth. Erosion from wind-generated waves can be minimized or eliminated by the use of appropriate levee materials, levee geometric design, and wave dissipation structures, and by reducing wind fetch and therefore the opportunity for wind waves to develop. The alternative designs presented in the conceptual plan (see figure 3-12 in chapter 3) utilize a combination of levee berms for providing wave dissipation and erosion protection, and internal peninsulas for reducing wave fetch and resulting wave heights.

Additional geotechnical and engineering studies will be conducted as the part of final design. The final design will include properly sized levees, levee erosion-protection measures, and internal peninsulas to prevent any significant impacts caused by levee erosion. Therefore, the impact of perimeter levee erosion is considered less than significant.

The potential exposure of levees to tsunamis or seiches is discussed in the *Geology, Soils, and Seismicity* section of this chapter.

Impacts and Mitigation Measures Common to Alternatives 1 and 2

Impact TH-7: Modification to Sedimentation Processes and Morphology in San Pablo Bay

The marsh plains in the BMKV tidal basins would accrete naturally by capturing sediments transported into the basins through tidal exchange. The sediment would consist mainly of bay muds resuspended by wave and wind activity and fine suspended sediment carried from upland sources by drainages emptying into San Pablo Bay, including Novato Creek. The capture of sediment in the basins would result in lower local sediment concentrations in the Bay, which could affect local sedimentation and morphological processes.

The conceptual design plans for Alternatives 1 and 2 include perimeter levee breaches and connecting channels along the San Pablo Bay shoreline and at the mouth of Novato Creek. Both alternatives call for the importation and placement of dredged material during the construction phase, which would significantly reduce the resultant tidal prism volume of each basin after breaching. Preliminary calculations of the sediment loading required to sustain maximum accretion rates in the basins range between 0.08 and 0.23 million tons of Bay sediments per year for the first 10 years. This is equivalent to only about 2–7%of the total estimated sediment inflow into San Pablo Bay from the Sacramento and San Joaquin Rivers combined (3.4 million tons per year). The sediment requirements of the basins for Alternatives 1 and 2 would also be relatively ephemeral and would be reduced to less than 1% after 20 years. The effect of sediment capture on the sedimentation processes and morphology of San Pablo Bay is thus considered a less-than-significant impact.

Impact TH-8: Modifications to Morphology of Novato Creek due to Breach of BMKV/Novato Creek Levee

The conceptual design plans for Alternatives 1 and 2 include a marsh basin connection to Novato Creek through a single levee breach. The breach would be located at the downstream end of the creek, only a few thousand feet from San Pablo Bay. Preliminary analysis of local scour from increased tidal prism reveals minor channel widening of between 10 and 25 feet along the portion of Novato Creek from the breach to the mouth, a distance of approximately 4,000 feet. The estimated change in depth is approximately 0.5 feet. These changes would be expected to occur along the existing main channel. Due to the short length of this corridor, it is estimated that between 10 and 20 acres of adjacent tidal marsh floodplain would be lost to erosion. This impact is considered less-than-significant because a primary purpose of the alternatives is the creation of new and additional marsh habitat, and the amount lost to erosion along Novato Creek

would be more than compensated for by the habitat created by implementing the alternatives.

In addition to main channel widening, the subtidal channel beyond the mouth of Novato Creek to the Petaluma channel (a distance of approximately 3000 feet) would also be subject to an increased tidal flow due to an increase in tidal prism. It is expected that 10 to 15 acres of existing mudflat along the subtidal channel would be eroded into mudflat channel because of the increased tidal prism from the upstream marsh basin connection. However, the loss of 10 to 15 acres of existing mudflat represents a small fraction of the total existing fringe mudflat along San Pablo Bay, and the proposed BMKV expansion is expected to create more than 50 acres of new mudflat habitat. This impact is considered less than significant.

These changes in morphology of the lower portion of Novato Creek are expected to occur directly adjacent to the existing main channel of Novato Creek from the breach to the mouth, and in the subtidal channel from the mouth to the Petaluma channel. Because adding tidal prism to this portion of the creek would cause a minor increase in channel width and depth, these changes in morphology are not expected to have a significant adverse effect on the navigability of Novato Creek. Since this portion of Novato Creek presently requires maintenance dredging to provide adequate channel size for boat passage, the addition of tidal prism is an incidental beneficial effect of the project on navigability of Novato Creek, although the authorized purpose of this project is not navigation. It should be noted that the project's potential addition of 400 to 600 acres of tidal prism to this portion of Novato Creek is not expected to result in sufficient channel width or depth to eliminate the need for future maintenance dredging.

Impact TH-9: Potential Increase in Existing Levee Erosion on Novato Creek

Both Alternatives 1 and 2 propose breaching and lowering the levee that separates Novato Creek from the BMKV site. The levee breach and lowering would result in increased tidal flow between the mouth of Novato Creek and the levee breach. This increase in discharge would result in limited widening (10 to 25 feet) and deepening (0.5 feet) of the existing subtidal Novato Creek channel from the location of the levee breach to the mouth of Novato Creek. Hydraulic analyses of lower Novato Creek indicate that small increases in channel and marsh plain velocities would result from the tidal wetland restoration. These small increases in velocity would not lead to significantly higher shear stresses on the existing Novato Creek levees and would not result in a significant effect on existing levee maintenance. This impact is considered less than significant.

Impacts and Mitigation Measures Unique To Alternative 3

Impact TH-10: Modification to Sedimentation Processes in San Pablo Bay

The Alternative 3 design relies on tidal exchange and natural accretion processes to develop marsh plains rather than direct placement of dredged material to accelerate development of tidal marsh conditions. For this reason, the combined tidal prism volume of the Alternative 3 basins would be substantially larger during the initial years of the projects, and the rate of sediment transport into the basins would be greater. Preliminary calculations of the sediment loading required to sustain maximum accretion rates in the basins range between 0.8 and 1.2 million tons of material for the first 10 years. This is equivalent to about 25–34% of the total estimated sediment inflow into San Pablo Bay from the Sacramento and San Joaquin Rivers combined. This impact is far more substantial than the impacts associated with Alternatives 1 and 2, and is considered significant. To mitigate this impact, the Conservancy or successors in interest shall implement Mitigation Measure TH-1.

Mitigation Measure TH-1: Perform an Assessment of Modifications to Sedimentation Processes in San Pablo Bay for Alternative 3 and Implement Phased Tidal Basin Development, if Necessary.
The volume of sediment captured each year by the design plan outlined in Alternative 3 could be reduced in half by phased development of the 2 basins. Opening only a single basin during the initial phase of the proposed BMKV expansion would reduce the maximum catch rate to about 0.55 million tons per year. This is equivalent to about 16% of the total estimated sediment inflow into San Pablo Bay from the Delta. After approximately 25 to 30 years, this value would drop to less than 3%. Once the capture rate of the first basin is no longer significant, the 2nd basin would be opened to tidal action.

Water Quality

Affected Environment

Data Sources

The evaluation of water quality effects is based on information presented in the following documents.

- *Hamilton Army Airfield Disposal and Reuse EIS* (U.S. Army Corps of Engineers 1996)

- San Francisco Bay Plan (San Francisco Bay Conservation and Development Commission 2001)
- Regional Toxic Hot-Spot Cleanup Plan (San Francisco Regional Water Quality Control Board 1999)
- *Draft – Beneficial Reuse of Dredged Materials: Sediment Screening And Testing Guidelines* (San Francisco Regional Water Quality Control Board 2000)
- *Report of the San Francisco Airport Science Panel* (National Oceanic and Atmospheric Administration1999)
- San Francisco Bay Region–Water Quality Control Plan (San Francisco Regional Water Quality Control Board 1995)
- Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California – Phase 1 of the Inland Surface Waters Plan and the Enclosed Bays and Estuaries Plan (State Water Resources Control Board 2000)
- *CALFED Bay Delta Program Final Programmatic EIR/EIS* (CALFED Bay Delta Program 2000)

Regulatory Setting

Federal Plans, Programs, and Policies

Clean Water Act

The EPA has granted the State of California primacy in administering and enforcing the provisions of the Clean Water Act (CWA) and NPDES. NPDES is the primary federal program that regulates point-source and nonpoint-source discharges to waters of the United States.

The State of California adopts water quality standards to protect beneficial uses of state waters as required by Section 303 of the CWA and the Porter–Cologne Water Quality Control Act of 1969 (PCWQCA).

Placement of clean fill materials into waters of the United States is regulated by Section 404 of the CWA, which is administered by the Corps. Under the CWA, the state RWQCB must issue Section 401 Water Quality Certification or a waiver for a project[1] to be permitted under Section 404. Water quality certification requires the evaluation of water quality considerations associated with dredging or placement of fill materials into waters of the United States.

[1] The term *project* used in this SEIR/EIS refers explicitly to the term as defined under CEQ's regulations for NEPA and the State CEQA Guidelines: "the entirety of an action which has a potential for resulting in a physical change in the environment." The Corps defines *project* as "an action that has been authorized by Congress," such as the HWRP. The BMKV expansion has not been authorized by Congress.

State Plans, Programs, and Policies

The McAteer–Petris Act of 1965

The McAteer–Petris Act, enacted on September 17, 1965, established the San Francisco Bay Conservation and Development Commission (BCDC) as a temporary state agency charged with preparing a plan for the long-term use of the Bay (Bay Plan). In August 1969, the McAteer–Petris Act was amended to make BCDC a permanent agency and to incorporate the policies of the Bay Plan into state law.

Any person or governmental agency wishing to place fill, extract materials, or make any substantial change in use of any water, land, or structure within the area of BCDC's jurisdiction must secure a permit from BCDC. Upon receiving an application for a permit, BCDC will transmit a copy of the application to the San Francisco Bay RWQCB. Within 30 days, the RWQCB must file a report with the commission that indicates the effect of the proposed project on water quality within the Bay. The main dredging policies that govern BCDC are listed below.

- Policy 1: Dredging and dredged material disposal should be conducted in an environmentally and economically sound manner.
- Policy 2: Dredging should be authorized when the Commission can find:
    a. the applicant has demonstrated that the dredging is needed to serve a water-oriented use or other important public purpose, such as navigational safety;
    b. the materials to be dredged meet the water quality requirements of the San Francisco Bay Regional Water Quality Control Board;
    c. important fisheries and Bay natural resources would be protected through seasonal restrictions established by the California Department of Fish and Game, the U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service, or through other appropriate measures;
    d. the siting and design of the project will result in the minimum dredging volume necessary for the project; and
    e. the materials would be disposed of in accordance with Policy 3.
- Policy 3: Dredged materials should, if feasible, be reused or disposed outside the Commission's Bay and certain waterway jurisdictions. Except when reused in an approved fill project, dredged material should not be disposed in the Commission's Bay and certain waterway jurisdiction unless disposal outside these areas is infeasible and the Commission finds:
    a. the volume to be disposed is consistent with applicable dredger disposal allocations and disposal site limits adopted by the Commission by regulation;
    b. disposal would be at a site designated by the Commission;

c. the quality of the material disposed of is consistent with the advice of the San Francisco Bay Regional Water Quality Control Board and the inter-agency Dredged Material Management Office (DMMO); and

d. the period of disposal is consistent with the advice of the California Department of Fish and Game, the U.S. Fish and Wildlife Service and the National Marine Fisheries Service.

- Policy 4: If an applicant proposes to dispose dredged material in tidal areas of the Bay and certain waterways that exceeds either disposal site limits or any disposal allocation that the Commission has adopted by regulation, the applicant must demonstrate that the potential for adverse environmental impact is insignificant and that non-tidal and ocean disposal is infeasible…or because the cost of disposal at alternate sites is prohibitive. In making its decision whether to authorize such in-Bay disposal, the Commission should confer with the LTMS agencies and consider the factors listed in Policy 1.
- Policy 5: To ensure adequate capacity for necessary Bay dredging projects and to protect Bay natural resources, acceptable non-tidal disposal sites should be secured and the Deep Ocean Disposal Site should be maintained. Further, dredging projects should maximize use of dredged material as a resource consistent with protecting and enhancing Bay natural resources, such as creating, enhancing, or restoring tidal and managed wetlands, creating and maintaining levees and dikes, providing cover and sealing material for sanitary landfills, and filling at approved construction sites.
- Policy 11: A project that uses dredged material to create, restore, or enhance Bay natural resources should be approved only if:

  1. The Commission…determines all of the following:

     a. the project would provide, in relationship to the project size, substantial net improvement in habitat for Bay species;

     b. no feasible alternatives to the fill exist to achieve the project purpose with fewer adverse impacts to Bay resources;

     c. the amount of dredged material to be used would be the minimum amount necessary to achieve the purpose of the project;

     d. beneficial uses and water quality of the Bay would be protected; and

     e. there is a high probability that the project would be successful and not result in unmitigated environmental harm;

  2. The project includes an adequate monitoring and management plan and has been carefully planned, and the Commission has established measurable performance objectives and controls that would help ensure the success and permanence of the project, and an agency or organization with fish and wildlife management expertise has expressed to the Commission its intention to manage and operate the site for habitat enhancement or restoration purposes for the life of the project;

3. The project is either a small pilot project or the success of similar projects has been demonstrated in similar settings;
4. The project would use only clean material suitable for aquatic disposal and the Commission has solicited the advice of the San Francisco Bay Regional Water Quality Control Board, the Dredged Material Management Office and other appropriate agencies on the suitability of the dredged material;
5. The project would not result in a net loss of bay surface area or volume. Any offsetting fill removal would be at or near as feasible to the habitat fill site;
6. Dredged material would not be placed in areas with particularly high or rare existing natural resource values, such as eelgrass beds and tidal marsh and mudflats, unless the material would be needed to protect or enhance the habitat. The habitat project would not, by itself or cumulatively with other projects, significantly decrease the overall amount of any particular habitat within the Suisun, North, South, or Central Bays, excluding areas that have been recently dredged;
7. After a reasonable period of monitoring, either:
    a. the project has not met its goals and measurable objectives, and attempts at remediation have proven unsuccessful, or
    b. the dredged material is found to have substantial adverse impacts on the natural resources of the Bay, then the dredged material would be removed, unless it is demonstrated by competent environmental studies that removing the material would have a greater adverse effect on the Bay than allowing it to remain, and the site would be returned to the conditions existing immediately preceding placement of the dredged material if; and
8. The Commission has consulted with the California Department of Fish and Game, the National Marine Fisheries Service, and the U.S. Fish and Wildlife Service to ensure that at least one of these agencies supports the proposed project.

BCDC must take action on a permit application, either denying or granting the permit, within 90 days after a complete application is filed. The permit will be automatically granted if BCDC fails to take specific action within that time period. A permit will be granted for a project if BCDC finds and declares that the project is either (1) necessary to the health, safety, or welfare of the public in the entire Bay Area; or (2) of such a nature that it will be consistent with the provisions of this title and the provisions of the San Francisco Bay Plan then in effect.

The Porter–Cologne Water Quality Control Act of 1969

The PCWQCA established the State Water Resources Control Board (SWRCB) and divided the state into 9 regional basins, each with a regional RWQCB. The SWRCB is the primary state agency responsible for protecting the quality of the State's surface and groundwater supplies.

The PCWQCA authorizes the SWRCB to draft state policies regarding water quality. In addition, the PCWQCA authorizes the SWRCB to issue Waste Discharge Requirements (WDRs) for discharges into state waters. The PCWQCA requires that the SWRCB or the RWQCB adopt water quality control plans (Basin Plans) for the protection of water quality. A Basin Plan must:

- identify beneficial uses of water to be protected,
- establish water quality objectives for the reasonable protection of the beneficial uses, and
- establish a program of implementation for achieving the water quality objectives.

The Basin Plans also provide the technical basis for determining WDRs, taking enforcement actions, and evaluating clean water grant proposals. The RWQCB adopted the most recent Basin Plan in May 1995. The San Francisco Bay RWQCB has jurisdiction over the expansion area.

Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California

The Enclosed Bays and Estuaries Plan (EBEP) (California State Water Resources Control Board 1990) set forth new objectives for the protection of aquatic life and human health. The water quality objectives in this plan were developed to apply statewide, and they apply to all estuarine waters in the project region. The plan contains objectives for regulating priority toxic pollutants, as listed under the CWA. The EBEP was the subject of a lawsuit brought against the SWRCB, alleging that the plan violated provisions of the Porter–Cologne Water Quality Act and CEQA. On October 15, 1993, a tentative decision was issued that overturned the plan and left the state technically without enforceable numerical objectives for those toxic pollutants regulated in the plan.

After rescission of the plan, the SWRCB and the EPA agreed to pursue a collaborative approach to reestablish the regulatory framework of the EBEP to bring California into compliance with the CWA. The Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California is the result of this effort. This State Policy for Water Quality Control, adopted by the SWRCB on March 2, 2000 and effective by May 22, 2000, applies to discharges of toxic pollutants into the inland surface waters, enclosed bays, and estuaries of California subject to regulation under the State's Porter–Cologne Water Quality Control Act (Division 7 of the Water Code) and the federal CWA. Such regulation may occur through the issuance of NPDES

permits, the issuance or waiver of WDRs, or other relevant regulatory approaches.

The goal of this policy is to establish a standardized approach for permitting discharges of toxic pollutants to non-ocean surface waters in a manner that promotes statewide consistency. As such, this policy is a tool to be used in conjunction with watershed management approaches and, where appropriate, the development of Total Maximum Daily Loads (TMDLs) to ensure achievement of water quality standards (i.e., water quality criteria or objectives, and the beneficial uses they are intended to protect, as well as the State and federal antidegradation policies).

This Policy establishes implementation provisions for priority pollutant criteria promulgated by the USEPA through the National Toxics Rule and through the California Toxics Rule, and for priority pollutant objectives established by the RWQCB in its Basin Plan.

California Regional Water Quality Control Board—San Francisco Bay Region

Water quality in streams and aquifers of the region is guided and regulated by the California RWQCB, San Francisco Bay Region. The RWQCB has primary authority for ensuring that water resources are protected from degradation by pollutant discharges. The State Policy for Water Quality Control aims to achieve the highest water quality consistent with the maximum benefit to the people of the state.

To develop water quality standards that are consistent with the uses of a water body, the RWQCB attempts to classify historical, present, and future beneficial uses as part of the Basin Plan. Beneficial uses of the major rivers and groundwater basins, along with narrative and numerical water quality objectives, are established in the Basin Plan for the region (Regional Water Quality Control Board 1995). The Basin Plan is periodically reviewed and updated pursuant to PCWQCA.

The USEPA has also promulgated freshwater and saltwater criteria for 126 priority pollutants (13 heavy metals, asbestos, and 112 organic compounds) in the National Toxics Rule. The State of California is currently developing the California Toxics Rule, which would promulgate new water quality criteria for the priority pollutants and supersede the National Toxics Rule in California.

The RWQCB is required to identify water bodies that do not meet water quality objectives pursuant to Section 303(d) of the CWA. Beneficial uses of surface water in the expansion area include municipal and domestic supply; agricultural supply; industrial service supply; groundwater recharge; contact and non-contact recreation; warm, freshwater habitat; cold, freshwater habitat; wildlife habitat; migration of aquatic organisms; and spawning, reproduction, and or early development. Beneficial uses of groundwater throughout the region include municipal and domestic supply, agricultural supply, and industrial service supply.

The Basin Plan has adopted the following objectives, which may apply to the proposed wetland restoration, to protect water resources.

- Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growth causes nuisance or adversely affects beneficial uses.
- Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses.
- Waters shall be free of discoloration that causes nuisance or adversely affects beneficial uses.
- No pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses.
- Discharges shall not result in pesticide concentrations in bottom sediment or aquatic life that adversely affects beneficial uses.
- Persistent chlorinated hydrocarbon pesticides shall not be detectable in water within the accuracy of the analytical methods approved by the USEPA.
- The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.
- Waters shall not contain suspended materials in concentrations that cause nuisance or adversely affect beneficial uses.
- Groundwater shall not contain chemical constituents in concentrations that adversely affect beneficial uses.

The Basin Plan also restricts increases in water temperature and reduction of dissolved oxygen concentrations, especially in water bodies supporting cold-water aquatic organisms.

Discharge of Waste to Land Regulations

The disposal of dredged material to land is regulated by the California Code of Regulations (CCR), Title 23, Division 3, Chapter 15, *Discharge of Waste to Land Regulations*, and is under the authority of the San Francisco RWQCB. Disposal of dredged material to augment existing levees or create upland habitat is considered upland disposal, and project approval by the San Francisco RWQCB would be based on the concentration of constituents of concern in the dredged sediment and site-specific conditions.

Aquatic Disposal of Waste Regulations

Wetland creation using dredged material is considered aquatic disposal under Section 404 of the CWA and is regulated by the California SWRCB and the San Francisco RWQCB under Section 401 of the CWA. The San Francisco RWQCB is responsible for ensuring that water quality objectives in the Basin Plan are not exceeded by a dredged material disposal project. The WDRs issued by the San Francisco RWQCB could require that discharge from a project comply with

screening criteria and testing guidelines for wetland creation and upland beneficial reuse to ensure that disposal does not result in degradation of the existing site.

Waste Discharge Requirements

The San Francisco RWQCB establishes WDRs to protect those beneficial uses identified in the Basin Plan. Beneficial uses protected by the Basin Plan that would be applicable to the proposed wetland restoration include wildlife and fish habitat, estuarine habitat, and preservation of rare and endangered species. In establishing WDRs, the San Francisco RWQCB considers the potential impact on beneficial uses within the area of influence of a discharge and the existing quality of receiving waters based on the appropriate water quality objectives.

WDRs issued for a project based on water quality objectives may contain more- or less-restrictive conditions that take into account factors such as economic considerations in addition to actual and potential beneficial uses. Because San Pablo Bay is considered a "water quality limited segment" in the Basin Plan, more stringent water quality objectives and treatment levels could be required for any discharge to this area. WDRs typically address turbidity, suspended solids, and other water quality issues.

NPDES Storm Water Discharge Permits

In 1992, the SWRCB adopted a General Construction Storm Water Discharge Permit, which will require land owners to file a Notice of Intent to discharge stormwater runoff to waters of the U.S., from land disturbances greater than 5 acres. The permit generally requires dischargers to eliminate non-stormwater discharges to stormwater systems, develop and implement a stormwater pollution prevention plan, and perform inspections of stormwater pollution prevention measures.

Streambed Alteration Agreement

A Streambed Alteration Agreement (DFG Code 1600 et. seq.) will be required for any work within a creek or stream and its floodplain. Streambed Alteration Agreements, commonly called 1603 Permits, may impose conditions to protect water quality during construction.

Regional Water Quality Conditions

San Pablo Bay is the receiving water for all drainage from the expansion site, including Novato Creek and Pacheco Pond. The Bay receives substantial inflow from the Sacramento and San Joaquin Rivers and smaller amounts of inflow from the Petaluma and Napa Rivers and Sonoma and Novato Creeks. Water quality is maintained by circulation and flushing as a result of tidal action and freshwater inflow. Water quality and salinity in the Bay are determined by the relative mix of these water sources.

In a natural system, surface-water quality depends primarily on the mineral composition of the rocks in the upper source areas of the stream. Farther downstream, the water quality is influenced by the mineral characteristics of the materials through which it flows and by contributions from tributaries. In an urban or developed system such as San Francisco Bay, water quality is also affected by discharges from point and nonpoint sources.

Water quality in San Pablo Bay has been evaluated as part of a study of San Francisco Bay (Aquatic Habitat Institute 1990). Data from the Aquatic Habitat Institute study indicate that levels of some pollutants may be lower than indicated by previous data. However, several pollutants are still present at levels of concern in San Pablo Bay and San Francisco Bay as a whole. Table 4-4 lists waters in the San Pablo Bay region that have been designated as impaired and the pollutants for which they were so designated. The designation as impaired can be the result of pollutants, such as heavy metals or pesticides, or a physical property of the water, such as dissolved oxygen or temperature.

The water quality in the San Pablo Bay tributaries is influenced by past and present agricultural activities. Sonoma Creek and the Petaluma and Napa Rivers are impaired by sediment, nutrients, and pathogens that are all related to the abundant agricultural activities found in their watershed. The North Bay and San Pablo Bay are also impaired by persistent agricultural chemicals, such as DDT and Chlordane, which may have been used anywhere in the Sacramento and San Joaquin Rivers watersheds. These areas are also impaired by metals and PCB's from past industrial and mining activities. Water quality in the area is further impaired because of mercury, and a health advisory has been issued for the entire San Francisco Bay estuary (California Regional Water Quality Control Board, San Francisco Bay Region 1997) because of mercury levels in aquatic life. Smaller drainages that drain primarily urban areas, such as Novato Creek, are impaired by persistent household insecticides, such as Diazinon.

Table 4-4. Waters in the San Pablo Bay and Tributary to the Bay Listed as Impaired by the San Francisco Bay Regional Water Quality Control Board under Section 303(d) of the Clean Water Act

Water Body/Waterway	Listed Impairment (Pollutant)
San Pablo Bay	Chlordane, DDT, Diazinon, Dieldren, Furan, Dioxin, PCBs, Cu, Hg, Ni, Se, coliform, exotic species
Napa River	Nutrients, Pathogens, Sedimentation/Siltation
Novato Creek	Diazinon
Petaluma River	Nutrients, Pathogens, Sedimentation/Siltation
Sonoma Creek	Nutrients, Pathogens, Sedimentation/Siltation
San Francisco Bay, North	Diazinon, Chlordane, DDT, Dieldren, Dioxin, Furan, PCBs, Cu, Hg, Se, exotic species

Source: State Water Resources Control Board 1999.

In addition to impaired water bodies identified by the SWRCB, the RWQCB has identified toxic hot spots where Bay sediments are contaminated. Table 4-5 lists the toxic hot spots in the San Pablo Bay and the contaminants found at each site.

Table 4-5. Areas in the San Pablo Bay that Have Significant Sediment Contamination

Site	Pollutants Present
Mare Island Naval Shipyard	As, Ag, Cr, Cu, Hg, Zn, TBT, PAHs, PCBs, dieldrin, endrin toxaphene
Hamilton Army Airfield	Cr, Hg, Pb, PAHs, PCBs, DDT, petroleum

Source: Regional Water Quality Control Board 1999

The *Hazardous Substances and Waste* section of this chapter discusses in greater detail mercury in San Pablo Bay, Novato Creek, and dredged material, including discussion of sediment screening criteria.

Site-Specific Water Quality Conditions

The existing soil conditions are important in determining water quality at the proposed wetland restoration site. The site is a former tidal salt marsh and mudflat. Soils in this area can affect water quality because of the presence of acid-sulfate soils. These soils have a low pH (high acidity) and are the result of draining the historic salt marsh and the subsequent natural processes that occurred with the oxidation of sediments that had previously been submerged and under anaerobic (oxygen-deprived) conditions. Acid-sulfate soil conditions may affect the quality of runoff because low pH levels can lead to water quality problems, such as release of sulfuric acid, aluminum toxicity and the potential for release of other metals, and fluctuations in nutrient levels.

Urban Runoff

Urban runoff from the adjacent properties is collected by a series of storm sewers and drainage channels to Pacheco Pond and then to Novato Creek. Natural areas have been disturbed over the years by grading and development. Runoff from paved areas is generally rapid. Water quality of runoff from the remaining natural, wooded, or grassy areas is likely to be good. Urban runoff from paved areas and other impervious surfaces can contain a variety of pollutants that can degrade water quality. Pollutants commonly found in urban runoff include heavy metals and petroleum hydrocarbons. The historic discharge of urban runoff from the former HAAF, adjacent to the expansion site, has affected the upper intertidal zone of the salt marsh near the pump station outfall. Elevated levels of metals, including high lead levels, and petroleum hydrocarbons have been found in

sediments in this area. The solvent trichloroethylene and metals have been found in the perimeter drainage channel.

Pacheco Pond

Pacheco Pond receives flow from Arroyo San Jose and Pacheco Creek, as well as stormwater runoff from the Ignacio Business Park. Pacheco Creek, runs through the northwest portion of the former HAAF. Ongoing monitoring of a closed landfill and an MTBE groundwater plume at HAAF, approximately 2,400 feet upgradient of the pond, has not shown migration of contaminants from the landfill or plume in the direction of the pond. The Corps has completed extensive environmental investigations at the airfield and runways and discovered no evidence of other contaminants migrating from HAAF towards Pacheco Pond (San Francisco Regional Water Quality Control Board 2001a).

In 2000 and 2001, there were several reports made to RWQCB of potential water quality problems in the pond. After a report of health problems by local sheriff's divers, RWQCB staff conducted an area-wide search of storm drains and runoff in the vicinity of the pond but did not identify an obvious pollution source. Water samples taken by RWQCB staff in mid December and again in late January detected a low level of MTBE at Pacheco Creek, within its historical concentration range, and benzoic acid at 100 parts per billion in the Pacheco Pond. Benzoic acid is used in the manufacture of cosmetics and creams; it has a half-life of 1 to 10 days in soil and water (San Francisco Regional Water Quality Control Board 2001a).

RWQCB staff received a complaint of a strong sulfur smell and dead fish at Pacheco Pond on April 2001. The complainant indicated that tide gates had been removed between the lower portion of the creek and the pond, causing swift water flows and pond flushing, and reported a milky white suspension of sediment over about three-quarters of the pond, as well as dead insects and fish. Preliminary results of 7 water samples taken by the complainant over a 20-hour period indicated slightly elevated pH in 1 sample and total suspended solids in excess of what is typically observed in stormwater runoff at 2 locations. According to RWQCB, the pH level reflects slight alkalinity but probably not enough to cause adverse effects to humans or wildlife. Sulfides in water were detected on the day following the incident, which is typical of small water bodies with low circulation (San Francisco Regional Water Quality Control Board 2001a).

As a follow-up to this concern, County staff took a number of sediment samples at various locations along Pacheco Creek, at storm drain outfalls, and from Pacheco Pond. Results of the County's sampling revealed concentrations of chlordane and DDT higher than would typically be expected for ambient levels for North Bay creeks. The highest concentration of chlordane was detected at a storm drain outfall downstream of Ignacio business park and nearby Ignacio trailer park. Concentrations of DDT were highest at a location in Pacheco Creek

that is within the boundary of the former HAAF. Although the pesticide concentrations were higher than ambient, they do not reflect levels that would be expected to cause immediate toxicity to fish or aquatic life, according to RWQCB (San Francisco Regional Water Quality Control Board 2001b).

To date, RWQCB has not identified an apparent link between the reported fish kills in late spring and the sediment data received. RWQCB and County staff have identified concerns that lack of aeration and circulation in Pacheco Pond, combined with stormwater runoff, may potentially be reducing dissolved oxygen, thereby causing periodic toxicity. The sulfur odors may also be derived from naturally occurring hydrogen sulfide that accumulates in the sediments and is released during pond flushing (San Francisco Regional Water Quality Control Board 2001b).

Permitted Discharges

Novato Sanitation District (NSD) discharges treated wastewater through a 54-inch reinforced-concrete pipe into San Pablo Bay. The outfall line follows the boundary between the SLC and HAAF parcels and discharges through a diffuser about 900 feet offshore into the intertidal zone of the Bay. Before the treated wastewater is discharged into the Bay, the NSD dechlorination plant performs final treatment of the wastewater discharge stream. Treated wastewater is discharged only during winter and spring months. During the balance of the year the treated wastewater is recycled and used for irrigation.

Groundwater

The shallow groundwater at the proposed wetland restoration site has a high salinity because of the historic influence of San Pablo Bay. Groundwater is of poor quality and is not used as a potable water source. A deep, higher-quality aquifer is present at an unknown depth. Because of the prevalence of bay muds, runoff is unlikely to recharge the deeper groundwater under the wetland restoration site. Groundwater may be influenced by freshwater levels in Pacheco Pond and may be less saline near the pond. The general direction of groundwater flow is to the east (Woodward-Clyde 1985). However, the low transmissivity of bay muds greatly reduces the movement of shallow groundwater into San Pablo Bay. Groundwater also discharges to the interior drainage channels and is pumped to San Pablo Bay.

Groundwater quality in the adjacent HAAF and SLC parcels has been affected by contaminants. The main contaminants of concern that have been found in groundwater are petroleum hydrocarbons, such as gasoline and oils, and solvents. These contaminants are discussed in more detail in the *Hazardous Substances and Waste* section of this chapter.

Wetland Water Quality

Wetland water quality is influenced by wetland depth and morphology and the relationship of the wetland to the upstream watershed. The hydrologic regime determines the frequency, depth, and duration of the water's influence on vegetation and the aquatic functions that the wetland provides. Wetlands with little flushing and high nutrient and contaminant loading rates can become stagnant, resulting in low dissolved-oxygen content, decreased aquatic habitat quality, and adverse effects on fish and wildlife. These conditions can also promote excess algal growth and increase mosquito-breeding potential. An adequate supply of fresh water to the wetland improves the capacity for removal of nutrients and contaminants. In a salt marsh environment, adequate tidal flushing maintains good water quality by reducing the potential for development of these conditions.

Wetlands can improve the quality of source waters by decreasing water velocity, inducing sediment deposition, and removing excess nutrients and contaminants. Nutrients and contaminants can adsorb (attach themselves) to sediments in a wetland and be removed by deposition, chemical breakdown, and assimilation into plant and animal tissues.

During winter months, Novato Creek tends to have freshwater flows due to high runoff conditions in the upstream drainage basin. During summer months, freshwater flows are low or negligible, and most of the water in the creek is from the Bay. Turbidity can be high because of the relatively shallow depths of water and the substantial currents that resuspend bottom sediments. Tidal flows, however, nourish and sustain the saltmarsh habitat along the levee at the east end of the proposed wetland restoration site, HAAF, and the SLC parcel adjacent to San Pablo Bay

Environmental Consequences and Mitigation Measures

Approach and Methods

Water quality effects were evaluated qualitatively based on professional judgement because detailed pollutant transport and fate numerical models are not available. Based on the environmental setting information, all sediments in the Bay are contaminated to some degree by anthropologic activities. Restoration, by natural sedimentation or dredge placement methods, would result in redistribution of Bay sediments and associated pollutants and would result in release of a portion of these pollutants into the overlying water column.

Potential water quality impacts were identified by comparing the proposed wetland restoration alternatives to the applicable laws and regulations regulating water quality in California. The water quality analysis also relies on other

sections in this chapter, especially *Geology and Soils, Surface-Water Hydrology and Tidal Hydraulics,* and *Hazardous Substances and Waste*.

Impact Mechanisms

Exceedance of Water Quality Objectives due to Dredged Material Placement Activities

The primary water quality concern associated with placement of dredged material (Alternatives 1 and 2) is the potential for formation of acid-sulfate soils. During the drying process, sulfides formed under anaerobic conditions while submerged are oxidized to sulfate, which then forms sulfuric acid on contact with water from runoff or rain. The acidic conditions and low pH (<5.5) can adversely affect aquatic life and wetland vegetation.

Other water quality issues associated with wetlands created with dredged material include:

- increasing concentrations of sulfide, ammonia, and phosphorus in brackish water and freshwater environments to levels exceeding those permitted by water quality objectives, both in drainage water from recently placed dredged material and in leached runoff after placement; and
- increasing concentrations of heavy metals in drainage water after placement of dredged material as a result of the conversion of soil chemistry from anaerobic (reducing) to aerobic (oxidizing) conditions, which increases the dissolved, readily soluble concentration of many heavy metals.

Dredged material could contain contaminants and other chemical constituents that pose a threat to water quality. There are several upland and aquatic pathways by which contaminants can threaten water quality in a wetland environment. The contaminant pathways are:

- effluent discharge;
- runoff;
- leachate runoff;
- seepage by soluble diffusion and soluble convection through tidal pumping and capillary action; and
- bioturbation, which includes the physical and biological activities that occur at or near the sediment surface that cause the sediment to become mixed.

These pathways also indicate the biotic resources potentially affected by the mobilization and accumulation of toxic contaminants. Water quality degradation could occur initially in surface water that comes into contact with levees or

wetland slopes. As seepage of surface water and leachate from sediment occurs, degradation of shallow groundwater could also occur.

Dredged sediment with chemical concentrations less than the concentrations listed in the *Hazardous Substances and Waste* section is acceptable for potential use in all wetland creation projects at any depth within the wetland (Wolfenden and Carlin 1992). Dredged material at lower concentrations is also acceptable for levee restoration and maintenance, landfill daily cover, and upland creation. The BMKV expansion would accept only dredged material that meets cover-material criteria.

Exceedance of Water Quality Objectives due to Natural Sedimentation Restoration Strategies

Water quality issues associated with wetlands created without dredged material (Alternative 3) are related to maintaining adequate flow and circulation. The hydrologic regime determines the frequency, depth, and duration of the water's influence on vegetation and the aquatic functions that the wetland provides. Wetlands with little flushing and high nutrient and contaminant loading rates can become stagnant, resulting in depressed dissolved-oxygen content, decreased aquatic habitat quality, and adverse effects on fish and wildlife. These conditions can also promote excess algal growth, generate noxious odors, and increase mosquito-breeding potential.

Exceedance of Water Quality Objectives due to Wetland Creation

Mercury has been introduced as a contaminant into the San Francisco Bay environment in various chemical forms from a variety of anthropogenic sources. In the San Pablo Bay specifically, mercury was introduced from gold mining in the Sierra Nevada

Although mercury often resides in forms that are not hazardous, it can be transformed through natural processes into extremely toxic methylmercury. Monomethylmercury is reported as the most bioavailable and biologically persistent form of mercury and is known to work its way up the food chain to cause serious illness and death in humans. The largest contributors of methylmercury in the environment appear to be sulfate-reducing bacteria, which occupy the anoxic sediment just below the sediment-water interface in water bodies and salt marshes.

Disturbance of mercury-contaminated sediments that were previously sequestered in biologically unavailable deep sediments has the potential to release mercury bound to sediments and sulfides. In addition, oxidizing conditions that occur during placement of materials can cause mercury and sediments to be released into overlying waters. Once released these mercury

cations become biologically available for mercury-methylating bacteria. The resultant concentration of methylmercury is dependent on numerous variables: salinity, pH, vegetation, sulfur concentration, dissolved organic carbon, ox/redox, and seasonal variations in each of the identified variables.

Exceedance of Water Quality Objectives due to Spillage Associated with Diesel Off-Loading and Booster Pumps

Diesel fuel may be spilled if diesel off-loading and booster pumps are used to pump dredged material from the off-loader onshore.

Exceedance of Water Quality Objectives due to Changes in Circulation of Pacheco Pond

The restoration alternatives include diversion of some or all of Pacheco Pond outlet flows from Novato Creek to the restoration site. Alternatives 1 and 3 also include expansion of Pacheco Pond. These changes may change circulation in Pacheco Pond, which may affect water quality.

Thresholds of Significance

The following significance criteria were used to evaluate the proposed BMKV expansion. Regarding water quality, the proposed expansion was identified as resulting in a significant impact on the environment if it would

- violate any water quality standards or waste discharge requirements,
- substantially degrade surface water and/or groundwater quality,
- contaminate a public water supply,
- substantially increase suspended solids in and turbidity in receiving waters, or
- discharge contaminants into the waters of the United States.

Impacts and Mitigation Measures of No-Action Alternative

Under the No-Action Alternative, the proposed wetland restoration site would remain in its present condition and drainage facilities would continue to be operated and maintained by the owner. Therefore, the No-Action Alternative would have no water quality effects.

Impacts and Mitigation Measures Common to Alternatives 1–3

Impact WQ-1: Potential for Degradation of Surface Water and Sediment Quality due to Increased Methylmercury Formation Potential

As previously described, mercury has been introduced as a contaminant into the San Francisco Bay environment in various chemical forms from a variety of anthropogenic sources.

Although mercury often resides in forms that are not hazardous, it can be transformed through natural processes into extremely toxic methylmercury. Monomethylmercury is reported as the most bioavailable and biologically persistent form of mercury and is know to work its way up the food chain to cause serious illness and death in humans. The largest contributors of methylmercury in the environment appear to be sulfate-reducing bacteria, which occupy the anoxic sediment just below the sediment–water interface in salt marshes.

Natural accretion processes in salt marshes continually supply fresh layers of sediment that release mercury cations and provide the environment for the methylation process. Once released, these mercury cations become biologically available for mercury-methylating bacteria. The resultant concentration of methylmercury is dependent on numerous variables: salinity, pH, vegetation, sulfur concentration, dissolved organic carbon, ox/redox, and seasonal variations in each of the identified variables.

Although it is likely that mercury methylation would increase as a result of the dredged placement approach, it is not clear whether the act of placement causes more notable effects than the natural methylation processes. As discussed in the *Hazardous Substances and Waste* section of this chapter, in addition to dredged material placement, sediment from Novato Creek or San Pablo Bay may also provide a source of mercury that may be methylated in the restored wetland area. It is also not currently possible, although models are being developed, to estimate the methylmercury concentrations and bioaccumulation and biomagnification in the food chain. Because a clear conclusion cannot be made regarding the potential for a significant adverse effect on the environment, this impact is considered significant and unavoidable. To minimize this effect, the following mitigation measure should be implemented.

Mitigation Measure WQ-1: Implement Methylmercury Adaptive Management Plan.

An adaptive management plan will be developed and implemented to address methylmercury production and accumulation in the restoration site. The plan should be developed in consultation with the responsible regulatory agencies (RWQCB, BCDC, Corps, NMFS, USFWS, federal EPA, DFG, etc.). Staff of

these agencies should be part of the adaptive management team to guide development of the plan; determine the duration, frequency of monitoring, constituents to be monitored, and monitoring protocols; and develop corrective actions as needed to minimize the adverse effects of methylmercury.

Key elements of this plan would include water- and sediment-quality monitoring, hydrodynamic monitoring, and benthic invertebrate monitoring. The purpose of the monitoring would be to determine whether methylmercury concentrations are found at substantially greater concentrations in the water column, sediments, or benthic invertebrate population at the restoration site than at reference sites.

Although it is generally thought that restoring large areas of salt marsh throughout the San Francisco Bay region is beneficial to the environment, large-scale restoration projects could expose populations of special-status species to methylmercury for many years. In addition, there is a potential for human health risks should increased production of methylmercury occur that results in increased mercury concentrations in fished species. The likely outcome of the adaptive management plan will be informed decision making that will guide the phased restoration of salt marshes throughout the San Francisco Bay.

Impact WQ-2: Potential Degradation of Groundwater Quality

Inundation of the expansion area could degrade shallow groundwater through saltwater intrusion or leaching of hazardous materials. However, the shallow groundwater in the expansion area already has a high salinity because of the historic influence of San Pablo Bay. Because of the presence of bay muds at the site, surface water and shallow groundwater are unlikely to recharge deeper groundwater. Saltwater intrusion and leaching of hazardous materials are therefore unlikely to occur. This impact is considered less than significant, and no mitigation is required.

Impact WQ-3: Potential for Degradation of Water Quality in Restored Wetlands from NSD Discharges

NSD seasonally discharges treated wastewater to the intertidal zone of San Pablo Bay. The overall NSD discharge flow rate is approximately 0.01% of the average tidal flow discharge in San Pablo Bay. Diffusion and mixing by the tidal and wind-driven circulation in the Bay provide ample opportunity for dilution of the wastewater discharge stream. Because of the high degree of dilution that the discharge stream undergoes upon release into San Pablo Bay and the relative separation of the diffuser from the entrance channels of the proposed tidal wetlands, the impact of return flows from the NSD facilities entering the proposed tidal wetlands is considered less than significant, and no mitigation is required.

Impact WQ-4: Beneficial Increases in Dissolved Oxygen Concentration in Receiving Waters.

Increasing the water surface of the Bay increases the potential gas exchange rate with the atmosphere, which would result in an increase in dissolved oxygen concentration in the Bay. Increased dissolved oxygen would increase the productivity of lowest levels of the food chain. Increased productivity would benefit all higher trophic-level organisms, such as anadromous fish (salmon and steelhead), resident fish, and piscivorous birds. Therefore this effect is considered a beneficial impact on the environment.

Impact WQ-5: Potential Exceedance of Water Quality Objectives due to Inadequate Flushing in Restored Wetlands

As described above under *Impact Mechanisms*, implementation of the proposed wetland restoration could create a water body with inadequate freshwater or tidal flushing and result in stagnation, resulting in depressed dissolved-oxygen concentrations and algal blooms. Assuming adequate flow and the absence of hazardous materials, water quality in created wetlands would probably be similar to that of incoming water sources such as Novato Creek, Pacheco Creek, and San Pablo Bay. This impact is considered less than significant, and no mitigation is required.

Impact WQ-6: Potential Diesel Pump Spills into San Pablo Bay

Operation and fueling of the diesel off-loading and booster pumps could result in spills of diesel into San Pablo Bay. This impact is considered significant, and the following mitigation should be implemented to mitigate this impact to a less-than-significant level.

Mitigation Measure WQ-2: Provide for Spill Protection at Off-Loader and at Booster-Pump Facility.

Design of the off-loader will include spill curtains, double-containment, or other design measures to reduce the potential for diesel fuel or engine oil to enter San Pablo Bay during pump operation, fueling, or maintenance. Institutional controls, such as adoption of a safety plan, will also be implemented to further provide spill protection.

Impact WQ-7: Potential for Changes in Salinity Levels within Novato Creek

Diverting some or all of the existing outlet that flows from Pacheco Pond to Novato Creek could lead to changes in the salinity levels in Novato Creek. Under existing conditions, there is minimal discharge from Pacheco Pond, which

is turn is limited by a tide gate that is located between the outlet channel and Novato Creek. During low-flow summer conditions, the flow from Pacheco Pond is minimal compared to the daily tidal prism on Novato Creek, and salinity levels within the creek are controlled by San Pablo Bay. During high flow conditions (i.e., during a storm event), overflows from Pacheco Pond and higher flows from Novato Creek push any saline waters out to the Bay. As soon as a storm event is over and high flows subside, salinity levels within the creek return to the background salinity of San Pablo Bay. The addition of freshwater from Pacheco Pond likely has a negligible effect on the salinity levels of Novato Creek because the resulting high flows from a storm event already cause a change in the creek's salinity levels due to an influx of freshwater flows. Pacheco Pond would add a few more hours, at most, of freshwater outflow to the creek during a storm event. The impact of diverting some or all of the outlet flows is thus considered less than significant.

Impact WQ-8: Potential Changes to Circulation in Pacheco Pond

RWQCB and County staff have identified that low circulation in Pacheco Pond combined with high summer temperatures could cause excess algal growth, leading to a reduction in the amount of dissolved oxygen in the water. This may be the cause of recent reported water quality problems in the pond (City of Novato 2001; San Francisco Regional Water Quality Control Board 2001a, 2001b).

Implementation of the alternatives would result in redirection of some or all of the existing pond outlet flows to the restoration site. Implementation of an amended water management plan for the pond, in cooperation with MCFCWCD and CDFG, is included as part of the project. Depending on the outlet facilities constructed for flow to the BMKV site and the management prescriptions to be developed in the water management plan, diversion of some or all of the outlet flows may result in changes in normally maintained pond elevations. If the outlet invert were set at the existing pond target elevation of 1.5 feet NGVD, then managed elevations of the pond would not change, thereby avoiding expansion of shallow portions of the pond that could otherwise exacerbate algal growth. If the outlet invert were set at elevations lower than the current target elevation, then the project could result in an expansion of shallow portions of the pond.

Under Alternatives 1 and 3, the design feature for Pacheco Pond includes an expanded pond. A larger volume of water could be more susceptible to wave action and thus enhance wind-derived circulation. However, in summer when temperatures are high and the pond receives limited inflow, the proposed expansion in pond volume, with no change in inflow, could exacerbate low dissolved-oxygen levels. Under Alternative 2, the pond would not be expanded, and the nominal volume of the pond would be unchanged.

Because the changes included under the alternatives have the potential to exacerbate apparent water quality conditions in Pacheco Pond, this impact is considered significant. The following mitigation is recommended to reduce this impact to less than significant.

Mitigation Measure WQ-3: Incorporate Pacheco Pond Water Quality Concerns in Amended Water Management Plan, in Cooperation with MCFCWCD and CDFG.

Water quality considerations will be taken into account during development of the water management plan. MCFCWCD is currently in the process of preparing a water management plan to which CDFG and the Conservancy, Corps, or their successor in interest will be a party. This plan will need to be amended to take into account the changes in pond outlet flows, construction of a new pond outlet, and potential expansion of the pond. Amending the plan to take into account water quality concerns may require additional studies of the water quality and circulation of the pond prior to establishing appropriate outlet design to BMKV and prior to establishing operating procedures. The amended plan will be developed in conjunction with final design of the wetland restoration project.

Impacts Common to Alternatives 1 and 2

Impact WQ-9: Potential for Degradation of Receiving Water Quality due to Dredged Material Placement

Construction of the restoration site using the dredged placement approach would include hydraulic placement of fill material. Dredged material would be pumped with water, as a slurry, from barges in the Bay to the restoration site. Once in the restoration site, the solids in the slurry would settle, and new slurry would be added. The surplus water would need to be pumped out of the restoration area and disposed of in the Bay. This surplus water, depending on the detention time, could have substantial concentrations of fines that would degrade the receiving waters by increasing the suspended solids and turbidity. Increases in suspended sediments and turbidity in the receiving waters is considered a significant impact. To reduce this impact to a less-than-significant level, Mitigation Measure WQ-3, described below, would be implemented.

Placement of dredged sediments would result in the saturation of existing acid-sulfate soils. Such conditions could affect the quality of runoff from the active construction area because of the low pH levels. The water quality problems associated with low pH include release of sulfuric acid, aluminum toxicity and the potential for release of other metals, and fluctuations in nutrient levels. These constituents could be discharged to San Pablo Bay or leach through onsite soils to groundwater. However, the procedure used to create wetlands (i.e. drainage into a water quality detention pond prior to discharge) would greatly dilute the small amount of sulfuric acid that could be released. Therefore this impact is considered less than significant.

The proposed BMKV expansion could also result in potential leaching of contaminants from dredged sediments, physical erosion and transport of the sediment by surface water currents and runoff, and selective uptake and biomagnification of contaminants in plants and animals. However, the sediments selected for use as cover material for tidal and seasonal wetland restoration at the expansion site would need to meet the RWQCB screening criteria, which would minimize the potential for bioaccumulation. Maintaining wet, anoxic sediment conditions would minimize pH changes and increases in leachability of heavy metals and other substances. Restricting disposal of sediments to those passing the cover screening criteria would ensure that no adverse impacts on surface-water quality would occur. This would be enhanced by the site design, which would promote sedimentation as a physical sink for incoming tidal sediment. Therefore, this impact is considered less than significant.

After the perimeter levee has been breached and full tidal circulation has been restored across the site, some of the dredged material would be remobilized. Tidal flows and velocities at the perimeter levee breach locations would increase localized erosion in the existing tidal slough channels and bordering marsh. Remobilization of the dredged material by tidal currents and wind-generated waves across the open fetches of the site would increase local turbidity and sedimentation until the eroded material is redeposited. No substantial offsite transport is anticipated. The impacts of increased turbidity and sedimentation would be short term, and offsite transport would eventually be eliminated when equilibrium is established in the restored tidal marsh and tidal sloughs. This localized, short-term impact is considered less than significant because high turbidity is characteristic of the water in dynamic tidal marsh environments.

Mitigation Measure WQ-4: Develop and Implement Water Quality Monitoring Program for Dredged Material Placement.

A water quality monitoring program will be developed and implemented to ensure adequate protection for aquatic life. Before the construction phase is initiated, water quality monitoring and reporting requirements for the proposed BMKV expansion will be established by the San Francisco RWQCB in project-specific WDRs in accordance with the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California. The WDRs will likely require sampling and analysis to provide background water quality information on the project's discharge. The data will be used to evaluate water quality of the discharge and determine compliance with the WDRs. Monitoring and reporting requirements will be based on site-specific conditions, such as beneficial uses, existing water quality, quality of dredged material, and wetland management goals.

The monitoring program will be initiated before implementation of the proposed BMKV expansion to determine background concentrations of constituents of concern, and will continue during construction to identify any adverse impacts.

After placement of dredged material, water samples should be collected and analyzed at frequencies ranging from monthly to quarterly and during both high

and low tides. Monitoring frequency may be reduced if data indicate that the created wetland is in compliance with WDRs and is not adversely affecting water quality. During dredged material placement, daily and/or weekly monitoring should be required for key constituents of concern, such as nitrate, ammonia, phosphorus, and heavy metals. Other water quality parameters to be monitored include salinity, temperature, pH, dissolved oxygen, and suspended solids.

Exceedance of monitoring standards may require temporary delays in material placement or the installation of turbidity curtains or other physical measures to control the flow of water and sediments.

Public Health

This section addresses the public health effects of implementing the proposed BMKV expansion. Because of the potential for mosquito-borne disease, the analysis focuses on the creation of potential breeding habitat for mosquitoes.

Affected Environment

Data Sources

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

- *Hamilton Wetland Restoration Plan Final EIR/EIS* (Jones & Stokes 1998)
- *Environmental Analysis of Tidal Marsh Restoration in San Francisco Bay* (Jones & Stokes 2001)

Mosquito Breeding Conditions

Mosquitoes require standing water to complete their growth cycle. Any body of standing water represents a potential breeding site for mosquitoes, with the exception of ponded areas that are flushed daily by tidal action. These areas are highly saline in nature and are not stagnant for a long enough period of time to support the mosquito larvae to maturity (Tietze 2001).

Water quality affects the productivity of a potential breeding site for mosquitoes. Typically, greater numbers of mosquitoes are produced in water bodies with poor circulation, higher temperatures, and higher organic content than in water bodies having good circulation, lower temperatures, and lower organic content (Collins and Resh 1989). In addition, irrigation and flooding practices may influence the level of mosquito production associated with a water body. Typically, greater numbers of mosquitoes are produced in water bodies with water levels that

slowly increase or recede than in water bodies with rapidly fluctuating water levels (Jones & Stokes Associates 1995).

Mosquito larvae flourish in stagnant water, particularly in small, protected microhabitats provided by stems of emergent vegetation. Therefore, if not properly maintained, ditches can be major producers of mosquitoes. Periodic dredging of ditches substantially reduces mosquito production by enhancing water circulation and preventing encroachment of emergent vegetation into ditch channels. Mosquitoes are adapted to breed during periods of temporary flooding and can complete their life cycles before water evaporates and predator populations become well established. Poor drainage conditions that result in ponding water, and water management practices associated with agriculture and creation of seasonal wetlands for waterfowl use result in the types of flooding that can produce problem numbers of mosquitoes (Jones & Stokes Associates 1995).

Permanent bodies of open water that have good circulation, low temperatures, and low organic content typically sustain stable nutrient content and support rich floral and faunal species diversity, including mosquito predators and pathogens. In addition, wave action across large bodies of water physically retards mosquito production by inhibiting egg laying and larval survival (Jones & Stokes Associates 1995).

There are 2 broad types of mosquito production sources present in the expansion area: habitats where water ponds permanently, and habitats where water ponds seasonally. Within the expansion area, water ponds permanently in portions of the drainage ditches on the BMKV site. Habitats that seasonally pond water in the expansion area include brackish marsh, seasonal wetlands, agricultural drainage ditches, and portions of cultivated fields that may pond water during the wet season. Table 4-6 shows the estimated acreages of potential mosquito breeding habitat in these areas. Within these areas, local suitability likely varies, depending on the extent and duration of ponding and on site-specific salinities and water currents.

Table 4-6. Estimated Acreages of Potential Existing and Post-Restoration Mosquito Breeding Habitat in the Expansion Area

Habitat Type	Existing Habitat	Alternative 1	Alternative 2	Alternative 3
Cultivated Fields (ponded areas within this habitat)	1,241	-	-	-
Brackish Drainage Ditches	36	-	-	-
Grassland (ponded areas within this habitat)	129	300	190	55
Seasonal Wetland	114	40	210	
Nontidal Salt Marsh	21	-	-	-
High Transitional Marsh	-	160	120	30
Open Water	15	40	-	40
Freshwater Emergent Wetland	-	10	-	10
Total	1,556	550	520	135

Marin–Sonoma Mosquito Abatement District

The expansion area is located within the jurisdiction of the Marin–Sonoma Mosquito Abatement District (MSMAD). Mosquito abatement districts (MADs) are governmental organizations formed at the local level that are responsible for controlling specific disease vectors within their jurisdiction. MADs receive most of their revenue from property taxes and are primarily responsible for controlling mosquitoes as pest species and as disease vectors. California law requires that if a problem source of mosquito production exists as a result of human-made conditions, the party responsible for those conditions is liable for the cost of abatement. The law is enforced at the discretion of the responsible MAD (California Health and Safety Code Section 2200 et seq.).

Although MADs do not have jurisdiction on state and federal lands, the Conservancy would coordinate with MSMAD to ensure that the proposed BMKV expansion does not create public health effects associated with the creation of new wetland habitat.

Criteria for Determining the Need for Control at a Mosquito Source

State laws and regulations require that mosquitoes be controlled if diseases transmitted by mosquitoes are identified in or near human populations, or if

surveillance of mosquito populations for the incidence of mosquito-transmitted diseases indicates the likelihood of transmission (Jones & Stokes Associates 1995). The decision to control mosquitoes as a nuisance to human populations is at the discretion of each MAD. Factors influencing this decision may include the number of service calls received from a given locality, the proximity of mosquito sources to population centers, the availability of funds for abatement, the density of mosquito larvae present in a mosquito production source, and the number of adult mosquitoes captured per night in light traps (Jones & Stokes Associates 1995). Once a recurring mosquito production source has been identified, abatement schedules are often adopted and maintained for that source (Jones & Stokes Associates 1995).

Mosquito Control Methods

To reduce mosquito populations, MADs use a combination of various abatement procedures, each of which may have maximum effectiveness under specific habitat conditions or periods of the mosquito life cycle (Jones & Stokes Associates 1995). Mosquito control methods used by MADs include use of biological agents (e.g., mosquitofish, which are predators on mosquito larvae) in mosquito breeding areas, source reductions (e.g., drainage of water bodies that produce mosquitoes), pesticides, and ecological manipulations of mosquito breeding habitat.

Mosquito Habitat Conditions and Abatement Requirements for the Expansion Area

MSMAD abatement efforts in the expansion area are primarily focused on controlling mosquitoes that can transmit malaria and several types of encephalitis, or cause a substantial nuisance in surrounding communities. Of the wetland habitats in the expansion area, seasonal wetlands, brackish drainage ditches, and ponded areas within cultivated fields are considered to have the potential to produce problem numbers of mosquitoes that may act as vectors for diseases in the area. Table 4-6 summarizes the acreages of those habitats at the BMKV site with the potential to produce problem numbers of mosquitoes.

Environmental Consequences and Mitigation Measures

Approach and Methods

Changes in mosquito abatement requirements for the expansion area were evaluated through a comparison of existing potential mosquito habitat with post-restoration potential mosquito habitat.

Impact Mechanisms

Impact mechanisms include conversion of areas that do not currently provide breeding habitat for problem numbers of mosquitoes (e.g., grasslands and developed areas) to wetland habitats that have characteristics suitable for producing problem numbers of mosquitoes, and changes in water management practices resulting from implementation of the restoration alternatives.

Thresholds of Significance

The following significance criteria were used to evaluate the proposed BMKV expansion. Regarding public health, the proposed expansion was identified as resulting in a significant impact on the environment if it would result in habitat changes that would necessitate increasing levels of mosquito abatement programs to maintain mosquito populations at pre-construction levels. Habitat changes that could result in a substantial decline of available mosquito breeding habitat or greater efficiency of MSMAD's abatement program would be considered beneficial impacts.

Impacts and Mitigation Measures of the No-Action Alternative

No impacts on the level of mosquito production or MSMAD's abatement program would occur under the No-Action Alternative because the expansion area would remain under the existing conditions, and no change in the current level of service provided by the MSMAD would occur.

Impacts and Mitigation Measures Common to Alternatives 1–3

All public health impacts of Alternatives 1, 2, and 3 are common to all 3 alternatives.

Impact PH-1: Increase of Potential Mosquito Breeding Habitat

Approximately 550, 520, and 135 acres of potential mosquito habitat would be created with implementation of Alternatives 1, 2, and 3, respectively. However, these acreages represent a collective decrease of approximately 1,000 to 1,400 acres of potential mosquito breeding habitat from the existing conditions on the expansion site, depending on the ponding potential of the cultivated fields currently onsite. During construction but before the perimeter levee is breached

to establish tidal flow to portions of the site, surface water may pond in depressions created in portions of the work site as a result of excavation, filling, and grading activities. Areas that pond water for periods sufficient to allow production of adult mosquitoes could also provide temporary suitable habitat for mosquito production. Overall, a decrease in mosquito production would likely occur with implementation of Alternative 1, 2, or 3. This would be a beneficial impact. Nevertheless, the following mitigation measure is recommended to ensure that suitable habitat for mosquito production remains controlled and properly regulated throughout construction and implementation.

Mitigation Measure PH-1: Coordinate Restoration Design and Expansion Activities with MSMAD.
The Conservancy and the Corps will consult and coordinate with MSMAD during design, implementation, and operations phases of the expansion. The Conservancy will be responsible for coordination with MSMAD regarding mosquito control measures for the expansion area following completion of construction. Consultation and coordination with MSMAD will include:

- development and implementation of water management strategies that reduce site suitability for mosquito breeding;
- air and ground applications of Bti (*Bacillus thurigiensis* var. *israelensis*), methoprene growth regulators, or other EPA-approved pesticides, as needed; and
- consultation with MSMAD to perform ongoing monitoring of larval and adult mosquito populations, water quality, and vegetation density, and to implement control and management measures under the authority of MSMAD.

Biological Resources

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 section describes existing biological resources present in the proposed expansion area and potential impacts on biological resources that may occur with implementation of the restoration alternatives.

Affected Environment

Data Sources

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

- *Bel Marin Keys Unit V Final Environmental Impact Report/Environmental Impact Statement* (Environmental Science Associates 1993)
- *Delineation of Clean Water Act Jurisdiction on Proposed Bel Marin Keys Project Site, Novato, CA* (LSA Associates 1997)
- *Special-Status Plant Surveys and Terrestrial Habitat Characterization of Four Mitigation Complexes, San Francisco Airport Expansion Project* (May & Associates 2001)
- *Hamilton Wetland Restoration Plan Final Environmental Impact Report/Environmental Impact Statement* (Jones & Stokes Associates, Inc. 1998)

Common and scientific names of plant and animal species mentioned in the text are presented in table D-1 in appendix D.

Biological Communities–HAAF and SLC Sites

The habitats present at the HAAF and SLC sites were described in the 1998 EIS/EIR prepared for the HWRP, which is incorporated herein by reference.

Biological Communities–City of Novato Land West of HWRP

The habitat present on the City of Novato land immediately west of the HWRP is discussed in this document because the Bay Trail would extend adjacent to this city-owned land under all 3 alternatives. The area west of the HWRP would also be the location of the interpretive center under Alternative 1. This area consists of annual grassland, concrete pads, and asphalt and dirt roads. The following description of annual grassland is from the HWRP EIS EIR (U.S. Army Corps of Engineers and California State Coastal Conservancy 1998).

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 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. No trees are present in the area to be crossed by the Bay Trail or at the proposed interpretive center.

Annual grassland provides important habitat for various wildlife species. The grassland 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 adjacent HAAF 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.

Biological Communities–BMKV Expansion Site

The habitats present at the proposed BMKV expansion site include aquatic, wetland, and grassland communities and developed areas. A substantial portion of the expansion site is agricultural land. These habitats and the plant and wildlife species associated with the BMKV site are described below. The biological setting in and around Pacheco Pond is described separately. The distribution of habitat types within each area is presented in figure 4-7, and the acreage of each habitat type in each area at BMKV is presented in table 4-7. Habitat types and acreages are derived from the results of previous habitat inventories of the expansion area.

Aquatic Communities

Aquatic communities found in the expansion area include subtidal aquatic (i.e., aquatic habitats that are never exposed during low tide), intertidal aquatic (i.e., emergent marsh habitat and mudflats that are exposed during low tides), and brackish open water habitats. Each of these is described below. A schematic of typical aquatic habitats by tide levels is provided in figure 4-8.

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 (bottom-feeding) 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 2 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 coastal salt marshes that are outboard of the perimeter levee. Mudflats are exposed twice daily during low tide and extend to the extreme low water elevation (figure 4-8). 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 organisms, including aquatic worms, crustaceans, and mollusks, that are important elements of the estuarine food web. When exposed or covered by shallow water, mudflats provide important foraging areas for migrant and wintering shorebirds, wading birds, and gulls.

Table 4-7. Estimated Extent of Habitat Types (Acres) Present in the BMKV Site under the No-Action Alternative and Alternatives 1–3 at Year 50 after Project Implementation, and the Net Change in Extent of Habitat Types Restored Under the Project Alternatives from the No-Action Alternative

	No-Action Alternative (i.e., Existing Conditions)	Alternative 1		Alternative 2		Alternative 3	
Habitat Type	Acres	Acres	Net Change	Acres	Net Change	Acres	Net Change
Coastal Salt Marsh (Tidal)	18[a]	1039[e]	+1021	1039[e]	+1021	1274[e]	+1256
Coastal Salt Marsh (Nontidal)	21[b]	0	-21	0	-21	0	-21
Tidal and Subtidal Channels	2	147	+145	137	+135	197	+195
Brackish Open Water and Emergent Marsh	52[c]	50[f]	-2	0	-52	50[f]	-2
Seasonal Wetland	114[d]	40	-74	210	+96	0	-114
Grassland (Upland)	129	300	+171	190	+61	55	-74
Agriculture (Non-Ponding)	1090	0	-1090	0	-1090	0	-1090
Agriculture (Ponding)	151	0	-151	0	-151	0	-151
Total	1576	1576	0	1576	0	1576	0

[a] Includes 17.5 acres of tidal marsh outside of levees
[b] Includes 5.8 acres of saline seeps and approx. 15 acres in Borrow Pits B and C
[c] Includes 36.0 acres of drainage ditches and approx. 15.5 acres in Borrow Pit A
[d] Includes 10.5 acres in western field, 24.9 acres in borrow pit field, and 79.0 acres in dredge spoil disposal field
[e] Includes low marsh, tidal marsh, and high transitional marsh
[f] Includes 40 acres of expanded Pacheco Pond and 10 acres of emergent marsh habitat

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. Emergent marsh habitat, however, is within the tidal zone and drains frequently; it is therefore 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.

Brackish Open Water Habitat

Brackish open water habitat occurs on approximately 52 acres of the BMKV site and includes 1 of the borrow pits and the drainage ditches. Borrow Pit A is 10–15 feet deep, intersects the water table year-round, and is perennially inundated in all but drought years (LSA Associates 1997). Open water in the borrow pit ponds is used by water birds during migration and provides foraging areas for resident waterfowl (Environmental Science Associates 1993). The approximate size of Borrow Pit A is 15 acres.

Drainage ditch banks and channels also provide foraging habitat and cover for some species, such as herons, egrets, and dabbling ducks, as well as movement corridors for striped skunks, raccoons, and other species. The area of the drainage ditches is approximately 36 acres and includes small amounts of brackish marsh vegetation along the edges of the ditches.

Wetland Communities

The expansion area contains 4 types of non-agricultural wetland communities: coastal salt marsh (tidal), coastal salt marsh (nontidal), small amounts of brackish marsh in the drainage ditches, and seasonal wetland (see table 4-7). In addition, seasonal ponding occurs within the cultivated fields, though it varies in magnitude from year to year. Delineation of jurisdictional wetlands has been completed for the BMKV parcel (LSA Associates 1997) and has been verified by the Corps and the Natural Resources Conservation Service (NRCS). All of the non-agricultural wetland types, except brackish open water, are considered jurisdictional wetlands by the Corps in accordance with the federal Clean Water Act. Approximately 151 acres of cultivated fields have also been delineated as jurisdictional agricultural wetlands based on determination of a statistically derived average ponding area, in addition to vegetation and soils criteria (LSA Associates 1997).

Coastal Salt Marsh (Tidal)

Coastal salt marsh under tidal influence occurs in 2 locations in the expansion area: between the levee at the eastern end of the expansion area and the open water of San Pablo Bay, and between the northern levee and Novato Creek. Approximately 20 acres of salt marsh habitat occur within the BMKV site, but more substantial areas are located outside the site. This habitat can be divided into 3 distinct zones based on the frequency and duration of tidal inundation (figure 4-8). These zones are described below.

- Low marsh habitat occupies the elevations between mean tide level and mean high water and, as such, is inundated daily. In the expansion area, low marsh is adjacent to the open waters of San Pablo Bay and Novato Creek and is dominated by California cordgrass.
- Middle marsh habitat occupies the elevations between mean high water and mean higher high water. It is predominant outboard of the perimeter levee and is inundated frequently throughout each month, although for shorter periods than low marsh. Middle marsh is dominated by common pickleweed.
- 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 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.

The tidal coastal 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 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 an important 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 at the proposed wetland restoration site during field surveys conducted in 2001 and 2002 include Double-Crested Cormorant, Great Blue Heron, Great Egret, American Coot, Killdeer, Northern Harrier, Salt Marsh Common Yellowthroat and San Pablo Song Sparrow (May & Associates 2001; Jones & Stokes files 2002). Other species expected to use tidal coastal 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 (approximately 21 acres total) are located along the interior slopes and base of levees along Novato Creek and San Pablo Bay and in 2 of the borrow pits. Dominant species include pickleweed, saltgrass, brass buttons, ryegrass, and coyote brush. These habitat areas may provide important refuge for wildlife associated with tidal salt marsh during periods of extreme high tides (Environmental Science Associates 1993).

Brackish Marsh

Small amounts of brackish marsh vegetation are present along the edge of the drainage ditches in the BMKV parcel. 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 larger, more contiguous units

of brackish marsh. The area of the brackish marsh vegetation has not been estimated.

Seasonal Wetlands

Areas of seasonal wetland (approximately 114 acres total) are present in the field at the west end of the site, adjacent to the borrow pits, and in the field previously used for placement of dredged material (on the northeast side of BMKV). Plant species that may dominate in seasonal wetland habitat are saltgrass, alkali heath, salt marsh bulrush, fat-hen saltplant, western goldenrod, sheep sorrel, 6-weeks fescue, tall fescue, sedge, rush, and creeping wild rye (Environmental Science Associates 1993).

Seasonal wetlands potentially provide high-tide refugia for California Clapper Rail, California Black Rail, and other species that use tidal coastal salt marshes; seasonal foraging and resting habitat for migratory shorebirds, waterfowl, and other water birds; and foraging habitat for raptors, herons, egrets, blackbirds, raccoons, striped skunks, and aquatic garter snakes (Environmental Science Associates 1993).

Agricultural Wetlands

During winter, some of the agricultural 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. Based on a statistically derived average ponding area, approximately 151 acres of agricultural wetlands have been delineated on the BMKV site (LSA Associates 1997). Because ponding amounts can vary in location and size by year, these areas have not been mapped.

Grassland Community

Annual grassland vegetation in the expansion area (approximately 129 acres total) 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. 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. Representative wildlife species observed using grasslands at the expansion site are the Turkey Vulture, White-tailed Kite, Northern Harrier, Red-tailed Hawk, Golden Eagle, American Kestrel, Short-eared Owl, Savannah Sparrow, Western Meadowlark, and Brewer's Blackbird (May & Associates 2001; Jones & Stokes files).

Agricultural Lands

Most of the proposed wetland restoration site (approximately 1,241 acres) is composed of 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, songbirds, and small mammals. As noted above, approximately 151 acres of the agricultural land have been delineated as agricultural wetlands.

Developed Areas

Human-made structures present within the expansion area include drainage pump stations, small out buildings, and utility infrastructures. Compared to vegetated habitats, these developed areas support a low diversity of wildlife. Species commonly associated with developed areas include the Barn Swallow, Northern Mockingbird, American Crow, and European Starling.

Biological Communities–Pacheco Pond

The general profile of existing biological resources in Pacheco Pond is based on the Hamilton Public Access Bay Trail Plan (Questa Engineering Corporation 2001), contact with MCFCWCD biologists, a field reconnaissance, and aerial photography.

Pacheco Pond is heavily used both in winter and summer by a variety of water birds, including waterfowl, grebes, loons, cormorants, rails, pelicans, coots, moorhens, terns, gulls, herons, egrets, shorebirds, and blackbirds. A number of species breed in the surrounding area due to the presence of a surrounding cattail marsh that provides food and cover. The pond itself also reportedly supports a number of fish species, including striped bass, smelt, and bullhead.

The confluence of Pacheco Creek and Arroyo San Jose creates a riparian area on the western side of Pacheco Pond that supports willows, non-native berries, and other freshwater riparian species. Saltmarsh Common Yellowthroat has previously been observed in the wetland/riparian area north and east of Ammo Hill (U.S. Army 1996). Northwestern pond turtle has been found in or near this area (Lewis 2002). A red-legged frog survey has been conducted in or near the confluence area, but no frogs were located (Lewis 2002).

The outflow from Pacheco Pond discharges into Novato Creek via a leveed channel, controlled by six flap gates. This structure apparently acts as a partial barrier to anadromous fish, in that access from Novato Creek to the Pacheco Pond outlet can only occur when flow from Pacheco Pond is sufficient to open the flap gates. This should occur in winter, following rains, at low-tide, but may not occur at all during summer. No self-sustaining runs of anadromous fish are known to exist in Pacheco Pond or its tributaries. However, in December of 2001, 3 adult chinook salmon were reported spawning in Arroyo San Jose Creek above Highway 101, upstream of Pacheco Pond (Lewis 2002). The reported individuals may have gained access to the area during maintenance of the Pacheco Pond outlet structure (Charldon 2002).

The presence of adult chinook salmon has been recorded in a number of rivers and creeks draining into San Francisco and San Pablo Bays, however it is not known whether any of these populations are self-sustaining (National Marine Fisheries Service 1999). It is believed that present day adults may have originated from numerous off-site releases of Central Valley hatchery fall-run chinook salmon into the delta or bay (National Marine Fisheries Service 1999). The chinook salmon reported in Arroyo San Jose were most likely fall-run chinook of hatchery origin. Other runs of chinook salmon which migrate through San Pablo Bay include winter and spring runs which typically spawn much higher in the river systems (450 to 900 and 45 to 1,600 meters elevation respectively) in upper mainstem reaches, higher streams, and the spring fed headwaters (Myers et al. 1998).

Based on aerial photography and site reconnaissance, all of the area adjacent to the confluence is wetland, as is the area between the northern end of the MCFCWCD access road and Bel Marin Keys Boulevard.

Special-Status Species

Special-status species are plants and animals that are legally protected under the state and federal Endangered Species Acts (ESAs) or other regulations, and other plants and animals that are considered sufficiently rare to qualify for consideration under NEPA and CEQA. The categories for special-status plants and animals are described below.

- Species listed or proposed for listing as threatened or endangered under the federal ESA (50 Code of Federal Regulations [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 ESA (61 CFR 7596-7613, February 28, 1996)
- Species listed or candidates for listing by the State of California as threatened or endangered under the state ESA (14 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 (CNPS) (California Fish and Game Code, Section 1900 et seq.)
- Plants considered by CNPS to be rare, threatened, or endangered in California (Lists 1B and 2 in California Native Plant Society [2001])
- Plants listed by CNPS as those about which more information is needed to determine their status and plants of limited distribution (Lists 3 and 4 in California Native Plant Society [2001]) that 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; California Department of Fish and Game and Point Reyes Bird Observatory 2001 [birds], Williams 1986 [mammals], Jennings and Hayes 1994 [amphibians and reptiles], and Moyle et al. 1995 [fish])
- 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 expansion area and their likely status in the area are presented in table D-1 in appendix D.

Special-Status Plants

Fourteen special-status plant species have potential to occur in or near the expansion area (appendix D); however, they are not present in the BMKV parcel. No special-status plant species have previously been reported from the expansion area (Natural Diversity Data Base 1997).

Potentially suitable habitat is present in the expansion area for only 3 of those species: soft bird's-beak, Point Reyes bird's-beak, and Marin knotweed (Environmental Science Associates 1993). This potential habitat 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 1980, 1985, 1988, 1991, and 2001 (Environmental Science Associates 1993, May & Associates 2001). Therefore, this analysis assumes that no special-status plant species are present in the expansion area or will be affected by the proposed BMKV expansion.

Special-Status Animals

Seventeen special-status fish and wildlife species are known to occur or are assumed to use suitable habitat within diked portions of the expansion area or in marshes and aquatic habitats bayside of the perimeter levees (see appendix D). These species are listed below.

- Longfin smelt
- Steelhead (Central Valley and Central California Coast ESUs)
- Chinook salmon (Sacramento River Winter-run, Central Valley Spring-run , and Central Valley Fall-run ESUs)
- Coho salmon (Central California Coast ESU)
- Double-crested Cormorant
- California Brown Pelican
- White-tailed Kite
- Northern Harrier

- Golden Eagle
- Peregrine Falcon
- California Clapper Rail
- California Black Rail
- Short-eared Owl
- Burrowing Owl
- Saltmarsh Common Yellowthroat
- San Pablo Song Sparrow
- Salt marsh harvest mouse

Invasive Non-Native Plant Species

Several invasive non-native plant species are of concern in the San Francisco Bay region. These plants often out-compete native vegetation, decrease species diversity, and eliminate habitat features necessary for special-status wildlife species. Of particular concern are several species of cordgrass, perennial pepperweed, and stinkwort.

Smooth cordgrass spreads by fragmentation of the rhizomes and, less commonly, by seed. Common cordgrass and dense-flowered cordgrass spread by both methods. Salt-meadow cordgrass appears to spread primarily by seed. Smooth cordgrass excludes the native California cordgrass. Where it invades open mudflats, it may reduce available habitat for foraging shorebirds, fish, and invertebrates.

The ecological consequences of non-native cordgrass invasion are not well known, and the effectiveness of control techniques is not well documented. The Conservancy is developing a separate EIR/EIS to address effects of controls, and the joint state–federal CALFED program is funding studies on effects and control strategies.

Perennial pepperweed is a widespread invasive species found in brackish to alkaline/saline wetlands (Bossard et al. 2000). It forms dense stands that exclude native species, including soft bird's-beak and Suisun marsh aster, 2 special-status plants that occur locally in the vicinity of North Bay marshes. Perennial pepperweed spreads by seed and by pieces of the root system.

Stinkwort or stink aster, an invasive non-native species that colonizes disturbed upland habitats and seasonal drainages, has been reported along Coyote Creek, at the Alviso Marina, and at Baylands Park in Sunnyvale (Preston 1997). At the marina, it occurs at the upper edges of tidal marsh. This species has only recently been identified as spreading to new areas in California, and its potential for displacing native species and altering habitat is not yet established.

Other non-native plants common in northern saltmarsh and adjacent upland habitats in the San Francisco Bay region are Mediterranean saltwort, brass buttons, slender-leaved iceplant, Australian saltbush, ripgut brome, and rabbit's-foot grass (Goals Project 2000).

Environmental Consequences and Mitigation Measures

This section describes methods used to analyze potential impacts of the restoration alternatives compared to the No-Action Alternative, potential impacts and impact mechanisms of each restoration 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 be present at the end of the 50-year evaluation period under each restoration alternative with habitat conditions under the No-Action Alternative. Fish and wildlife species that occur or have potential to occur in the expansion area 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 one of the restoration alternatives (e.g., noise associated with equipment operation).

A major assumption used in this analysis is that conditions predicted to result with implementation of the restoration alternatives would actually develop within 50 years of implementation of the proposed expansion. 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 would evolve and their distribution on the expansion site is somewhat speculative, however, 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 under each of the restoration alternatives within 50 years of implementation of the proposed expansion.

- All potential sources of surface and subsurface hazardous materials on the expansion site will be removed or isolated before the selected restoration alternative is implemented.
- All dredged material and other fill material from offsite sources used for construction will meet the criteria and standards established by the DMMO and other regulatory agencies with jurisdiction over the site.

Impact Mechanisms

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

- Creating a staging area to provide storage of topsoil, heavy equipment, fuel and supplies
- Modifying existing power towers by jacketing them in asphalt and concrete, and driving heavy equipment to and from the towers
- Excavating the upper foot of topsoil and removing it to a staging area
- Operating equipment and other construction activity, including constructing internal and perimeter levees and trails, grading, and excavating channels and levee breaches
- Operating a hydraulic off-loader 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 1 and 2)
- Reintroducing tidal flow to currently nontidal lands
- Constructing a water-quality detention pond at the mouth of the excavated main channels
- Installing drainage and other water-control infrastructure (under Alternatives 1 and 2)
- 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
- Colonization of invasive non-native vegetation species that displace or prevent establishment of native vegetation potentially lowering the habitat value of restored wetlands
- Constructing, accessing, and using the Bay Trail

Thresholds of Significance

The following significance criteria were used to evaluate the proposed BMKV expansion. Regarding biological resources, the proposed expansion was identified as resulting in a significant impact on the environment if it would result in

- long-term degradation of a sensitive plant community because of substantial alteration of land form or site conditions, including a decrease in the acreage of intertidal and subtidal aquatic habitats and a decrease in the acreage or quality of tidal or nontidal wetlands;
- substantial loss of a plant community and associated wildlife habitat, including a substantial decrease in the acreage or quality of waterfowl breeding or wintering habitat or a substantial decrease in the acreage or quality of migrant and wintering shorebird habitat;
- fragmentation or isolation of wildlife habitats;
- substantial disturbance of wildlife resulting from human activities;
- avoidance by wildlife of biologically important habitat for substantial periods, which may increase mortality or reduce reproductive success;
- disruption of natural wildlife movement corridors; or
- substantial reduction in local population size attributable to direct mortality or habitat loss, lowered reproductive success, or habitat fragmentation of:
  - species that are federally or state listed or proposed for listing as threatened or endangered;
  - portions of local populations that are candidates for federal or state listing and federal and state species of concern; or
  - species qualifying as rare and endangered under CEQA.

The following were also considered in determining whether an impact on a biological resource would be considered significant:

- federal or state legal protection of the resource;
- federal, state, and local agency regulations and policies regarding the resource;
- documented local or regional scarcity and sensitivity of the resource; and
- local and regional distribution and extent of the resource.

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

Impacts and Mitigation Measures of the No-Action Alternative

Under the No-Action Alternative, no wetland restoration would occur, and the expansion site would remain in its present condition. No change in the current quantity or quality of biological resources would be anticipated, and no mitigation measures would be required.

Impacts and Mitigation Measures Common to Alternatives 1–3

Figures 3-1 through 3-6 (in chapter 3 of this document) illustrate the distribution, 50 years after implementation of the proposed expansion, of habitats restored under Alternatives 1, 2, and 3. Table 4-7 presents a comparison of the estimated extent of habitat restored under each of the restoration alternatives and the expected net change in the extent of habitats relative to the No-Action Alternative (i.e., existing conditions).

Impact BIO-1: Increase in Subtidal Aquatic Habitat for Resident and Anadromous Fish

Subtidal aquatic habitat is expected to increase under Alternatives 1, 2, and 3. As sediment deposition occurs, the open-water habitat created initially by breaching the levees would decrease. Because dredged material would be placed to raise the existing elevation of the expansion area before breaching levees under Alternatives 1 and 2, the rate at which the extent of open water decreases under those alternative is expected to be much greater than under Alternative 3. 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 BIO-2: Short-Term Loss of or Disturbance to and Long-Term Increase in Intertidal Mudflats

A small area of intertidal mudflat could be lost or disturbed near the bayside termini of the excavated subtidal channels 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 the development of intertidal

mudflat habitat 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 4-8). As sediments are deposited and the site develops, intertidal mudflats would be present in varying amounts. When the wetlands are fully functioning, 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 replaced under each of the restoration alternatives. Intertidal mudflats, however, are expected to develop more rapidly under Alternatives 1 and 2 than under Alternative 3 because placement of dredged materials will accelerate their development.

Impact BIO-3: Temporary Disturbance to the Northern Harrier, White-tailed Kite, Golden Eagle, Short-eared Owl, Burrowing Owl, Saltmarsh Common Yellowthroat, and San Pablo Song Sparrow during Construction

Noise, vibration, visual, and proximity-related disturbances associated with construction could adversely affect the Northern Harrier, White-tailed Kite, Golden Eagle, Short-eared Owl, Burrowing Owl, Saltmarsh Common Yellowthroat, and San Pablo Song Sparrow during the breeding season. If individuals of these species nest in the expansion area during the construction period, construction disturbances could cause them 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 Conservancy, Corps, or successors in interest would implement Mitigation Measure BIO-1.

Mitigation Measure BIO-1: Conduct Surveys to Locate Northern Harrier, White-tailed Kite, Golden Eagle, Short-eared Owl, Burrowing Owl, Saltmarsh Common Yellowthroat, and San Pablo Song Sparrow Nest Sites before Construction Is Initiated and Avoid Breeding Sites. The Conservancy, Corps, or successors in interest will conduct surveys to locate Northern Harrier, White-tailed Kite, Golden Eagle, Short-eared Owl, 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 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 BIO-4: Potential for Construction-Related Mortality of Salt Marsh Harvest Mice

Breaching and lowering the perimeter levee and excavating tidal channels in the outboard marsh could result in direct mortality of salt marsh harvest mice, a federally listed and state-listed endangered species. This impact is considered significant. To reduce this impact to a less-than-significant level, the Conservancy, Corps, or successors in interest would implement Mitigation Measure BIO-2.

Mitigation Measure BIO-2: 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 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 identify other appropriate methods for avoiding construction-related mortality of salt marsh harvest mice.

Impact BIO-5: Potential for Construction-Related Mortality of California Clapper Rails and California Black Rails

Breaching and lowering the perimeter levee and excavating tidal channels 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 expansion activities could result in the direct mortality of individuals of these 2 special-status species. To reduce this impact to a less-than-significant level, the Conservancy, Corps, or successors in interest would implement Mitigation Measure BIO-3.

Mitigation Measure BIO-3: Avoid Operation of Equipment in the Outboard Tidal Coastal Marsh during the Breeding Period of the California Clapper Rail and California Black Rail.

The Conservancy, Corps, or successors in interest will avoid operating construction equipment in the outboard tidal marsh from February 1 to July 31. A 250-foot buffer has been previously recommended in the LTMS Biological Opinion and for activities that have occurred as a result of restoration activities under the HWRP. This buffer is also recommended for the BMKV expansion. 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 rails. If

rails are located, the 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.

Impact BIO-6: 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 expansion activities could result in the mortality of individuals of this special-status species. To reduce this impact to a less-than-significant level, the Conservancy, Corps, or successors in interest would implement Mitigation Measure BIO-4.

Mitigation Measure BIO-4: Conduct Surveys to Locate San Pablo Song Sparrow Nest Sites before Construction Is Initiated and Avoid Breeding Sites.

The Conservancy, Corps, or successors in interest will conduct surveys to locate San Pablo Song Sparrow breeding territories 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 breeding territories are not located, construction may proceed. If breeding territories are located, the 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 breeding territories, or sequencing construction activities to avoid potential impacts on the species during the breeding season).

Impact BIO-7: 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 Conservancy, Corps, or successors in interest would implement Mitigation Measure BIO-5.

Mitigation Measure BIO-5: Conduct Surveys to Locate Burrowing Owl Nest Sites before Construction Is Initiated and Avoid Breeding Sites.

The Conservancy, Corps, or successors in interest will 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, but the 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 BIO-8: Potential for Construction-Related Mortality of Outmigrating Salmonid Smolts

Breaching and lowering the perimeter levee and excavating tidal channels could result in direct mortality of outmigrating salmonid smolts if individuals were present when construction occurred. This impact is considered significant because expansion activities could result in the direct mortality of individuals of special-status species. To reduce this impact to a less-than-significant level, the Conservancy, Corps, or successors in interest would implement Mitigation Measure BIO-6.

Mitigation Measure BIO-6: Avoid Construction that Could Affect Tidal Aquatic Habitats when Salmonid Smolts Could Be Present. The Conservancy, Corps, or successors in interest will, to the extent feasible without impeding successful construction completion, avoid construction activities that could affect tidal aquatic habitats (e.g., construction associated with lowering the perimeter levee and excavating tidal channels through the outboard salt marsh) during periods when outmigrating salmonid smolts could be present. If construction activities must occur during periods these species could be present, the Conservancy, Corps, or successors in interest will consult with , NMFS and DFG to determine what, if any, additional mitigation measures may be required to allow construction to proceed.

Impact BIO-9: Potential for Reduced Access to Freshwater Habitat for Anadromous Salmonids

Installation of culvert structures into the Pacheco Pond levee to redirect some or all of the existing outlet flows into the restoration site could result in reduced anadromous fish access to freshwater habitats of the tributaries to Pacheco Pond (Arroyo San Jose and Pacheco Creeks). Currently, anadromous fish access to Pacheco Pond and its tributaries is limited by the existing pond outlet structures. Depending on the final culvert structure design chosen and decisions embodied in the amended water management plan for Pacheco Pond concerning outlet flow, anadromous fish access to Pacheco Pond and its tributaries could be reduced or eliminated.

There do not appear to be any self-sustaining runs of anadromous salmonids in Pacheco Pond and its tributaries (National Marine Fisheries Service 1998). The recently reported sighting (December 2001) of 3 adult chinook salmon in Arroyo San Jose Creek are most likely fall-run strays of hatchery origin based on the watershed in question (San Pablo Bay tributary), timing of occurrence (December), and known distributions (habitat elevation below 450 meters). Fall-run chinook are a candidate species, and the latest status review did not indicate that the run warrants listing. Because these do not appear to be self-sustaining runs and do not appear to include listed species, this impact is considered less-than-significant. However, since one of the purposes of Pacheco Pond management is wildlife habitat conservation, potential fish passage should be considered when developing the amended water management plan for Pacheco Pond.

Impact BIO-10: 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, could be required to ensure restoration success. These activities could result in disturbance to or mortality of special-status species if special-status species occupy restored habitats. This impact is considered significant. To reduce this impact to a less-than-significant level, the Conservancy, Corps, or successors in interest would implement Mitigation Measure BIO-7.

Mitigation Measure BIO-7: Develop and Implement a Restoration Management and Maintenance Program Designed to Minimize Potential Impacts on Special-Status Species.

The Conservancy, Corps, or successors in interest will develop a restoration management and maintenance program, in coordination with USFWS, NMFS and DFG, within 1 year after the completion of 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 BIO-11: 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, would therefore continue to provide flood refugia for mice and rails. Therefore, this impact is considered less than significant and no mitigation is required.

Impact BIO-12: Increase in Suitable Habitat for the Brown Pelican and Double-crested Cormorant

Breaching the perimeter levee and introducing tidal flow to the expansion 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 were 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 expansion site aggrades with sedimentation and vegetation becomes established. Because placement of dredged material under Alternatives 1 and 2 is expected to increase the rate at which tidal coastal salt marsh develops, suitable habitat area for these species would decrease more rapidly under these alternatives than under Alternative 3. At maturity, subtidal channels would continue to provide suitable habitat for these species. This impact is considered beneficial.

Impact BIO-13: Increase in Suitable Nesting Habitat for Resident Waterfowl

Development of undisturbed grassland, seasonal wetland, and tidal coastal marsh vegetation, all of which are expected to increase under each of the restoration alternatives (see table 4-7), would substantially increase the area of suitable waterfowl nesting habitat. This impact is considered beneficial.

Impact BIO-14: Loss of Coastal Salt Marsh

Excavation of subtidal channels through the tidal marsh would result in the direct loss of a small amount of high-, middle-, and low-tidal coastal salt marsh (estimated at 1 to 3 acres) and the conversion of small areas (approximately 21 acres total) of nontidal coastal salt marsh to tidal coastal salt marsh. In addition, breaching onto Novato Creek in Alternatives 1 and 2 could result in loss of an additional 10 to 20 acres of tidal marsh through morphologic change along the lower creek due to the increase in tidal prism.

As a result of implementation of the proposed BMKV expansion, tidal marsh vegetation is expected to gradually colonize the newly established 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 expansion, 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 would be reduced because established vegetation would attenuate wave energy across the site.

The loss of tidal and nontidal coastal salt marsh habitat is expected to be offset by tidal coastal salt marsh habitat that would develop on the site at a greater than 2:1 in-kind replacement ratio within 10 years following implementation of the proposed expansion. At maturity, an estimated 1,039, 1,039, and 1,274 acres of tidal coastal salt marsh would be restored under Alternatives 1, 2, and 3, respectively (see table 4-7). At ultimate maturity, the proposed BMKV expansion would provide a greater than 25:1 ratio of restored habitat. Establishment of tidal coastal salt marsh habitat would take longer under Alternative 3 than under the other alternatives due to the time it takes natural sedimentation to result in marsh plain elevations. If coastal salt marsh habitat developed as designed, the net increase in this habitat type would be a beneficial impact. Because of uncertainties regarding the rate of sedimentation and the associated rate of establishment of native salt marsh vegetation, however, there could be a time lag between the physical construction of the restoration site and establishment of new salt marsh habitat. Therefore, this temporal reduction in the amount of salt marsh habitat is considered a significant impact. To reduce this impact to a less-than-significant level, the Conservancy, Corps, or successors in interest would implement Mitigation Measure BIO-8.

Mitigation Measure BIO-8: Monitor Site Development and Implement Actions to Increase the Rate of Marsh Development, If Required.
The Conservancy, Corps, or successors in interest will develop and implement a 15-year monitoring program to measure the rate of tidal 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 again in years 10 and 15 following implementation of the proposed expansion. The monitoring program will be designed to determine whether coastal tidal marsh is developing and whether its primary supporting physical processes (i.e., tidal exchange and sedimentation) are occurring at the estimated rate during the first 15 years of implementation of the proposed expansion.

Major elements of the monitoring program will include the following.

- Measure the extent of tidal coastal salt marsh removed to construct subtidal channels to determine the amount of tidal coastal salt marsh that must be restored to compensate for loss of tidal coastal salt marsh at an in-kind

replacement ratio of 2 acres restored for every acre of tidal salt marsh removed.

- Monitor parameters, including tidal stage, tidal current, wind speed and direction, wave characteristics, suspended sediment concentrations, sedimentation rates and distribution, marsh elevations, mudflat elevations, areal extent and locations of established or colonizing salt marsh vegetation, composition and density of established and colonizing plant species, characteristics of subtidal channel and marsh surface sediments, and San Pablo Bay shoreline characteristics.
- Monitor locations, including the tidal wetland interior, tidal wetland perimeter, subtidal channels, and existing San Pablo Bay marsh shoreline.
- Compare predicted and measured site development and function.
- Analyze monitoring data to identify possible reasons for differences between observed and predicted conditions.
- Recommend remedial actions that could be implemented if the restoration is not proceeding as designed.

Monitoring reports will be submitted by the Conservancy, Corps, or successors in interest to the DFG, USFWS, and NMFS 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 replace each acre of affected tidal coastal salt marsh with 2 acres of contiguous, in-kind habitat within 10 years of implementation of the proposed expansion, the Conservancy, Corps, or successors in interest will review the proposed BMKV expansion with representatives of DFG, USFWS, and NMFS to determine whether additional actions or 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 modifications are necessary to meet restoration goals.

Monitoring of morphologic evolution will allow state and federal governments and agencies to assess the success of habitat development and make decisions regarding corrective measures if necessary. Potential corrective measures include changing the breach and subtidal channel dimensions, altering perimeter levee berm morphology, and modifying channel characteristics within the restored tidal wetlands to ensure adequate morphologic evolution.

Impact BIO-15: Loss of Brackish Open Water Habitat and Brackish Marsh

Establishing tidal exchange at the expansion site would result in the direct loss of brackish open water habitat associated with Borrow Pit A and the drainage ditches, as well as the loss of brackish marsh vegetation on the edge of the

drainage ditches. With diversion of some or all of the existing Pacheco Pond outlet flow to the restoration site, there is also a potential for siltation of the pond outlet channel between Bel Marin Keys Boulevard and Novato Creek, which could result in loss of brackish open water and emergent habitat that may be present along the edge of the channel. The loss of brackish open water habitat would be offset by the creation of the expanded Pacheco Pond and 10 acres of emergent marsh around the expanded pond under Alternatives 1 and 3 and by the creation of 210 acres of seasonal wetlands under Alternative 2.

Because of uncertainties regarding the development of subsurface and surface hydrology and the associated quantity of brackish open water and emergent marsh vegetation (Alternatives 1 and 3) or seasonal wetlands (Alternative 2) habitats of sufficient quality and quantity may not establish rapidly enough to offset impacts that occur during construction and inundation of the restoration site. To reduce this impact to a less-than-significant level, the Conservancy, Corps, or successors in interest would implement Mitigation Measure BIO-9.

Mitigation Measure BIO-9: Monitor Development of Brackish Open Water, Emergent Marsh, and/or Seasonal Wetlands.
The Conservancy, Corps, or successors in interest will develop and implement a 5-year monitoring program to measure the establishment rate, quantity, and quality of brackish open water, emergent marsh, and/or seasonal wetlands. Major elements of the monitoring program will include the following.

- Measure 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.
- Recommend remedial actions that can be implemented if the restoration is not proceeding as designed.

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

Impact BIO-16: Loss of Seasonal Wetlands

Creating tidal exchange at the expansion site and constructing the internal levees would result in the loss of seasonal wetland habitat, totaling approximately 114 acres (see table 4-7). These areas occur as inclusions within highly disturbed non-native annual grassland. Because of their size, location, and level of disturbance, the wetlands provide few of the functions and values of higher quality seasonal wetlands. Under Alternative 1, approximately 40 acres of seasonal wetland would be restored in the swale area. Under Alternative 2,

approximately 210 acres of seasonal wetland would be restored adjacent to Pacheco Pond. Under Alternative 3, approximately 10 acres of seasonal wetland would be restored. The loss of seasonal 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 in-kind seasonal wetlands elsewhere on the expansion site that are expected to be of substantially higher habitat quality than the present seasonal wetlands as well as substantially greater acreage of out-of-kind tidal wetlands.

Impact BIO-17: Loss of Agricultural Wetlands

Creating tidal exchange at the expansion site and constructing the internal levees would result in the loss of agricultural ponding habitat totaling approximately 151 acres, based on the ponding analysis conducted as part of the wetland delineation (see table 4-7). Because of their size, location, and level of disturbance, the wetlands provide few of the functions and values of higher quality seasonal or other wetlands. Under Alternative 1, approximately 40 acres of seasonal wetlands, 40 acres of open-water habitat, 10 acres of emergent marsh around the expanded Pacheco Pond, and substantial amounts of tidal wetlands would be restored (see table 4-7). Under Alternative 2, approximately 210 acres of seasonal wetland and substantial amounts of tidal wetlands would be restored. Under Alternative 3, approximately 10 acres of seasonal wetlands, 40 acres of open-water habitat, 10 acres of emergent marsh around the expanded Pacheco Pond, and substantial amounts of tidal wetlands would be restored. The loss of agricultural 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 both in-kind and out-of-kind replacement wetlands expected to be of higher quality.

Impact BIO-18: Loss of Grassland

Constructing expansion levees, breaching levees, restoring wetlands, and inundation and other features of the restoration would result in the direct loss of approximately 129 acres of grassland habitat. Loss of grasslands would reduce the available habitat area for raptors, Western Meadowlarks, Brewer's Blackbirds, and other regionally abundant songbirds.

The loss of grassland habitat would be offset by the creation of an estimated 300, 190, and 45 acres of higher quality grasslands near restored seasonal wetlands under Alternatives 1, 2, and 3, respectively (see table 4-7). 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 the grassland affected by the proposed BMKV expansion. 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.

Impact BIO-19: 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 salt marsh habitats. As described in Impact BIO-14, tidal coastal salt marsh would be lost as a result of construction of the proposed expansion restoration features in the tidal marsh. If restoration performs as predicted, suitable habitat for these species could be increased by approximately 1,021 acres under Alternative 1, approximately 1,021 acres under Alternative 2, and approximately 1,256 acres under Alternative 3. Establishment of tidal marsh would take longer under Alternative 3 than under the other alternatives. However, because of uncertainties regarding the development of new 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 BIO-14). Therefore, this impact is considered significant. To reduce this impact to a less-than-significant level, the Conservancy, Corps, or successors in interest would implement Mitigation Measure BIO-8.

Impact BIO-20: Temporary Loss of Nesting Habitat for San Pablo Song Sparrow

Coastal salt marsh and brackish marsh support suitable nesting habitat for the San Pablo Song Sparrow. Implementation of wetland restoration could result in removal of up to approximately 21 acres of nontidal coastal salt marsh and limited amounts of brackish marsh vegetation in the drainage ditches. If restoration performs as predicted, the extent of suitable species habitat could be increased by more than 1,000 acres under the restoration alternatives (see table 4-7). Establishment of tidal coastal salt marsh habitat would take longer under Alternative 3 than under the other alternatives. However, because of uncertainties regarding development of the new marshes, this analysis assumes that the quality, type, and minimum habitat patch size required by this species may not develop (as described under Impacts BIO-14 and BIO-15). Therefore, this impact is considered significant. To reduce this impact to a less-than-significant level, the Conservancy, Corps, or successors in interest would implement Mitigation Measures BIO-8 and BIO-9.

Impact BIO-21: Temporary Loss of Nesting and/or Foraging Habitat for Northern Harrier, White-tailed Kite, and Short-eared Owl

Construction activities associated with levee and seasonal wetland construction and inundation of approximately 129 acres of grassland habitat and 1,241 acres of agricultural lands by tidal flow would result in the permanent loss of suitable Northern Harrier, White-tailed Kite, and Short-eared Owl nesting and/or foraging habitat. The loss of nesting and/or foraging habitat would be offset by the creation of 300 acres of upland and approximately 1,039 acres of tidal coastal salt marsh habitat under Alternative 1, approximately 190 acres of grassland and 1,039 acres of tidal coastal marsh habitat under Alternative 2, and approximately 45 acres of grassland and 1,274 acres of tidal coastal salt marsh under Alternative 3 (table 4-7). This impact is considered less-than-significant, and mitigation is not required.

Impact BIO-22: Loss of Foraging Habitat for Golden Eagle and Burrowing Owl

Construction activities associated with levee and seasonal wetland construction and inundation by tidal flow of approximately 129 acres of grassland habitat and 1,241 acres of agricultural lands would result in the permanent loss of suitable Golden Eagle and Burrowing Owl foraging habitat. This loss of foraging habitat would be partially offset by restoration of 300, 190, and 45 acres of upland habitat under Alternatives 1, 2, and 3, respectively (table 4-7). This impact is considered less than significant because the loss of Golden Eagle and Burrowing Owl foraging habitat represents a small fraction of the available foraging habitat for these species in the region.

Impact BIO-23: Temporary Loss of Foraging Habitat for Wintering Waterfowl

Approximately 1,241 acres of agricultural land that provides foraging habitat for wintering waterfowl would be lost as a result of implementing Alternatives 1, 2, or 3 (see table 4-7). Lost agricultural foraging habitat, however, would be replaced by restored grassland, seasonal wetland, brackish marsh, and coastal tidal marsh habitats under each of the alternative. These restored habitats are expected to support suitable foraging and resting habitat for migrating and wintering waterfowl. Because most of the expansion area would not be accessible for recreation or other public uses, the expansion 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 less than significant.

Impact BIO-24: 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 expansion area under Alternatives 1, 2, or 3 would initially create areas of tidal mudflat around the edges of and along channels in the tidal marsh restoration area. Under Alternative 3, the extent of tidal mudflat over the 5-year evaluation period would be greater than under the other alternatives because tidal coastal salt marsh vegetation would require longer to establish. Tidal mudflats are expected to support large numbers of benthic organisms that are prey for shorebirds. As the site experienced aggradation but before large portions of the tidal marsh became vegetated, the area of tidal mudflat would increase; as the site continued to mature, tidal mudflats would primarily be limited to slough channels and along the margins of subtidal channels. This impact is considered beneficial.

Impact BIO-25: Potential for Spread of Invasive Non-Native Plants within and outside of Restoration Area during Construction Activities

Construction activities, including onsite grading in preparation for placement of dredged material, and use of dredged material from areas of the Bay could result in the spread of non-native invasive plant species that are problematic in the San Francisco Bay region. Of particular concern are several species of cordgrass, perennial pepperweed, and stinkwort.

Grading and use of dredged material could result in the spread of non-native cordgrasses, including smooth or salt-water cordgrass, common cordgrass, a fertile hybrid between smooth cordgrass and a British cordgrass, dense-flowered cordgrass, and salt-meadow cordgrass.

Smooth cordgrass is of highest concern because of its prevalence and its ability to alter native northern saltmarsh habitat, colonize tidal mudflats, and reduce the open water and capacity of channels (Bossard et al. 2000, Cohen and Carlton 1998, Callaway and Josselyn 1992).

Perennial pepperweed has been observed along Novato Creek near the BMKV site. Presence of this species may inhibit the establishment of native vegetation in floodplain areas adjacent to tidal channels. Tires and equipment could spread this species to uninfested areas in the course of construction and grading activities.

Stinkwort is currently known from the South Bay and is likely to be restricted to levee banks and upland areas, and is consequently not expected to affect tidal

habitats. It has the potential, however, to be a serious pest species and should be monitored.

Mediterranean saltwort, brass buttons, slender-leaved iceplant, Australian saltbush, ripgut brome, rabbit's-foot grass, and other invasive non-native plants have the potential to prevent establishment of native plants in and near areas where restoration activities are undertaken.

The potential for the spread of invasive non-native plants during construction could reduce the quality and function of the resulting marsh habitats. Furthermore, establishment of one or more of these species could create source populations that could subsequently invade other areas and potentially reduce the success of other tidal marsh restoration efforts. Implementation of the two mitigation measures described below could substantially mitigate this effect.

Mitigation Measure 10a: Prevent Spread of Perennial Pepperweed and Other Invasive Weeds to Uninfested Areas.
A qualified botanist will conduct a non-native plant assessment of areas subject to construction activities and will recommend specific measures to control spread of non-native species. Measures may include the establishment of wash stations for construction vehicles and equipment to clean tires of weed seeds and other propagules before they are moved offsite, and the development of an herbicide spray program to destroy perennial pepperweed or other invasive weed infestations prior to construction.

Mitigation Measure 10b: Monitor Restoration Sites for and Control Infestation by Invasive Non-Native Plants.
After being planted, restoration areas will be monitored for infestation of non-native cordgrasses, perennial pepperweed, stinkwort, and other potentially invasive species. All infestations occurring within wetland habitats will be controlled and removed to the extent feasible without jeopardizing the establishment of surrounding native vegetation. A long-term monitoring plan will be developed, subject to review and approval by USFWS and DFG, that will remain in effect until marsh habitat is established.

Impact BIO-26: Biological Benefit from Increases in Organic Carbon and Nitrogen Concentrations

As stated in the San Francisco Bay Area Ecosystem Goals Project (1998) study, the biological productivity of the Bay has been diminished due to the lack of salt marsh habitats. Biological productivity or potential biological productivity can be measured by the organic carbon and nitrogen concentrations present in a marsh system. Under the proposed BMKV expansion, restoring or creating salt marsh habitat (i.e., sub-tidal and tidal habitat) provides the increased area where mineral nutrients such as nitrate and orthophosphate and atmospheric carbon are converted to organic forms through the nitrogen and carbon cycle. Organic carbon and nitrogen are the primary building blocks for lower trophic-level

organisms, which provide food for higher-level organisms. This potential for an increase in productivity is considered a biological benefit.

Impact BIO-27: Disruption of Sensitive Wildlife due to Bay Trail Construction, All Alternatives

All of the alternatives include extending the Bay Trail along the southwest perimeter of the HWRP and northward from the City of Novato levee to Pacheco Pond. The impacts of Bay Trail construction along the trail areas common to all alternatives is discussed in this section. Impacts unique to each alternative are discussed separately below.

The 2 areas common to all alternatives are (1) the southwestern perimeter of the HWRP, where the trail would be extended from the Hamilton residential area along existing roads and levees to a point approximately 700 feet from the outboard levee; and (2) the area west of the HWRP, north of the City of Novato levee. The EIS/EIR for the authorized HWRP analyzed the effects of construction of levees and wetland restoration adjacent to these areas, but did not include a Bay Trail at the areas proposed in this document.

Levees would be built as part of the HWRP along the existing southern perimeter of the HAAF parcel and northward from the City of Novato levee to Pacheco Pond. No levee is proposed in the area between the southern perimeter levee and the pump station near the baseball field and residential area.

The southward extension of the Bay Trail would be on the existing paved and concrete areas south of the pump station until the perimeter levee is reached. The perimeter levee would be improved as part of the HWRP because it would be adjacent to the HWRP tidal wetland area. Construction of the levee was analyzed in the prior EIS/EIR and is not reanalyzed here. Construction of the Bay Trail on the levee as part of completion of the levee is not expected to result in any additional impact on sensitive wildlife. Very little construction would be necessary to place the Bay Trail on the existing paved and concrete areas.

The northward extension of the Bay Trail would be in 1 of 3 places: along the levee to be constructed from the City of Novato levee to Pacheco Pond, along existing roads, or across annual grassland areas west of the HWRP. If constructed along the new levee or existing roads, there would be little to no impact to sensitive wildlife. If constructed across the grasslands west of the HWRP, the impact would be similar to Impact BIO-3 described above, and Mitigation Measure BIO-1 should be implemented to reduce this impact to less than significant. The loss of a limited amount of grassland, if the trail crossed grassland areas, is considered less than significant.

Impact BIO-28: Disruption of Sensitive Wildlife due to Public Access Interactions along the Bay Trail

All of the alternatives include extending the Bay Trail along the southwest perimeter of the HWRP and northward from the City of Novato levee to Pacheco Pond. Each alternative includes a route for the Bay Trail from the south side of Pacheco Pond to Bel Marin Keys Boulevard. In addition, each alternative includes a spur option to extend a trail to Novato Creek through BMKV. Each alternative has the potential for disruption of sensitive wildlife by public access in proximity to sensitive wetland habitat that exists at present in and around Pacheco Pond, Novato Creek, and San Pablo Bay. In addition, future public access would be adjacent to wetland areas created as part of the restoration project. The specifics of each Bay Trail or spur option route and its potential construction and access impacts are discussed later in this section under impacts unique to each alternative. The following discussion presents information about the general nature of potential access-related impacts for all 3 restoration alternatives.

In 1996 independent scientific consultants to the Bay Trail Project undertook an extensive literature search for material that addressed public-trail-related impacts on wildlife, in preparation for a scientific field study (Sokale and Trulio 1996). Out of hundreds of abstracts that were reviewed by consultants to the Bay Trail Project, only 25 were found that specifically addressed the topic of human-disturbance impacts on wildlife. Moreover, only 8 of those 25 were field studies that directly assessed impacts of trail-related activity on wildlife. The conclusions drawn from these studies were varied, though the 8 field studies all showed some adverse impact on wildlife from trail activity (San Francisco Bay Conservation and Development Commission 2001).

The most common responses reported were animals moving away in response to human activity, and changes in species diversity and abundance near trails. Six of the studies reported immediate effects on animal behavior, such as moving away from the trail when users approached the study site. Only 1 study was done in the San Francisco Bay Area. That study looked at the amount of human disturbance at 4 wetland sites and found that, as human disturbance at a site increased, the number of birds decreased. The study did not compare the study sites to control sites (San Francisco Bay Conservation and Development Commission 2001).

The San Francisco Bay Trail Project is currently conducting a scientific study of the potential effects of non-motorized recreational trails on shorebirds and waterfowl that use mudflat foraging habitat adjacent to the San Francisco Bay Trail. The study examines impacts to birds in their foraging habitat. Potential effects of trail use on species abundance and diversity adjacent to breeding habitat are not a part of the study. Preliminary findings based on early analyses showed no general relationship between human use of trails and bird abundance or diversity in foraging habitats at the 3 locations studied in the San Francisco

Bay Area (San Francisco Bay Conservation and Development Commission 2001).

There are presently many unknowns surrounding the possible effects of public access on wildlife. The initial results of the 2 studies noted above in the San Francisco Bay area are varied.

BCDC prepared a draft report in 2001 that reviews Bay Plan access policies and existing scientific understanding of access/wildlife interactions, and provides guidance concerning design of public access for enhancing wildlife compatibility. Key conclusions of the report include the following.

> "There is evidence that public access may have adverse effects on wildlife. Adverse effects on wildlife from human activities may be both direct (such as harassment or harvest) and indirect (such as habitat modification), and effects can be both immediate and long term. Immediate effects may include: nest abandonment (which may increase risk of predation of eggs or young); flushing; and increased stress, which can lead to reduced feeding or site abandonment. Long-term effects may include decreased reproductive success, decreased population within species, or decreased number of total species. If improperly sited, public access may fragment habitats and serve as predator access routes to wildlife areas."
>
> "Potential adverse effects from public access can be addressed through the employment of siting, design, and management strategies to avoid or minimize adverse effects, including such strategies as use restrictions, buffers, periodic closures or the prohibition of public access in specific areas. Siting, design and management strategies can be effective in avoiding or reducing adverse effects on wildlife."
>
> "There is a need for more, well-designed, scientific studies of effects of human activities on wildlife, both on a local scale in the San Francisco Bay Area, and on a national scale in similar habitats with similar recreational uses."

BCDC also reviewed the potential benefits of various siting, design, and management strategies that may be used to avoid or minimize adverse effects of public access on wildlife. These possible strategies include the following (San Francisco Bay Conservation and Development Commission 2001).

- Durable Materials–Construction of durable pathways can reduce erosion and limit creation of alternative access routes that may be unsafe or muddy.
- Varied Access Experiences–Varied and interesting access experience can keep users in designated areas and limit creation of informal routes.
- Spur Trails/Point Access–Limit physical access to sensitive areas while providing users with some access.
- Parking/Staging Access–Location away from sensitive areas can reduce use levels within 0.25 to 0.5 mile from staging areas.

- Buffers–Use of vegetation, open space, and fences can provide physical, visual, and/or sound barriers between users and sensitive wildlife.
- Boardwalks/Bridges–Confine access to designated areas while allowing hydrologic connections to be maintained.
- Overlook Points–Provide for visual access while limiting direct contact/proximity.
- Seasonal/Periodic Closures–Reduce potential interactions during breeding or other sensitive wildlife periods.
- Use Restrictions–Control adverse effects of dog access, wildlife feeding, fishing, motorized vehicles, etc.

Although the specific design features for the Bay Trail or spurs to the Bay Trail have not been selected, the potential for access/wildlife impacts is considered a significant impact under all 3 alternatives because of the proximity of existing or future sensitive habitats and wildlife. The specifics of the potential impacts of each alternative route are discussed later in this section. Regardless of the route selected, Mitigation Measure BIO-11 would be implemented by the Conservancy, Corps, or successors in interest to reduce this impact of access on sensitive wildlife to a less-than-significant level.

Mitigation Measure BIO-11: Incorporate Wildlife-Sensitive Approaches in Bay Trail Design and Develop Trail Management Plan.

The Conservancy, Corps, or successors in interest will develop the final design for any proposed Bay Trail routes or spur trail options in coordination with BCDC, DFG, USFWS, the County of Marin, the City of Novato, and the Bay Trail project. The specific trail design will include consideration of at least the following.

- Timing of trail construction
- Trail construction materials
- Use of vegetative, open-space, fencing, or other buffers
- Use of overlook points, point access, and spur trails
- Segregation of trailheads, parking, and staging from sensitive habitat

In addition, a trail management plan will be developed in cooperation with the same agencies. Specific design and management requirements that have already been identified for each potential route are noted below. Annual monitoring results may identify needs to changes in management of trail use and/or trail restrictions.

Impact BIO-29: Disruption of Sensitive Wildlife due to Public Access Interactions along the Bay Trail, Southward and Northward Extensions

The habitats currently adjacent to the southward extension of the Bay Trail include grassland and developed areas, and a drainage ditch along the southern perimeter levee that appears to contain some riparian vegetation. Salt marsh is located east of the outboard marsh, approximately 700 feet from the proposed terminus of the Bay Trail. With implementation of the HWRP, tidal and seasonal wetlands would be established north of the Bay Trail in this area.

The habitats currently adjacent to the northward extension of the Bay Trail from the City of Novato levee to Pacheco Pond include annual and fescue grasslands. There is a drainage ditch on the south side of Pacheco Pond and west of where the Bay Trail may be routed. With implementation of the HWRP, seasonal wetlands would be established east of the levee on the west side of the HWRP.

Public access along these portions of the Bay Trail has the potential to disrupt existing wildlife that uses the grassland and drainage ditch along the southern trail extension and the grasslands along the northward extension to Pacheco Pond. Because the southern extension of the Bay Trail would stop 700 feet west of the existing salt marsh, access impacts on the existing salt marsh would be less than significant. Future access has the potential to disrupt sensitive wildlife that may utilize the seasonal and tidal wetlands to be created by the HWRP. This impact is considered significant, and Mitigation Measure BIO-12 is recommended to reduce this impact to a less-than-significant level.

Mitigation Measure BIO-12: Implement Specific Design and Management Mitigation for Bay Trail Southward Extension and Northward Extension from City of Novato Levee.

The following will be incorporated into the design and trail management for the southward and northward extension of the Bay Trail from the City of Novato levee.

- Place signage at the terminus of the southward extension trail along the perimeter levees.
- Place physical buffers (such as vegetation), periodic signage, or barriers (such as fencing), as determined in consultation with USFWS and CDFG to prevent or discourage public access into areas of sensitive species habitat.
- Prohibit all dog and motorized vehicle access (except for emergency vehicles).
- Establish seasonal closures of the trail spur along the perimeter levee during the peak breeding seasons of sensitive species (such as Saltmarsh Common Yellowthroat and California Clapper Rail), in consultation with DFG and USFWS, once the restored seasonal and tidal wetland areas begin to be used by sensitive species.

Impact BIO-30: Changes in Predator Access

At present, the BMKV site provides unimpeded access for predators, such as dogs, red-tailed fox, and raccoons, to the salt marsh outboard of the perimeter levees and the other habitats onsite. Such access may affect the sensitive species found in these marsh areas, such as the California Clapper Rail.

Implementation of one of the restoration alternatives would reduce, but not eliminate predator access to the outboard marsh. Each alternative would include the construction of levees for control of tidal flooding or improvement of existing levees and berms. These levees and berms would continue to provide predator access to portions of the outboard marsh. However, the access across the existing agricultural fields would be impeded due to the introduction of tidal flows across the site, and the perimeter levees would be lowered to an approximate high-tide level, which should reduce predator use and access to portions of the outboard marsh. As noted above, the trail management plan for the Bay Trail and any spur trails built as part of the project would prohibit people from bringing dogs on the site. Because the project would reduce predator access compared to the existing setting, this impact is considered less-than-significant.

The Conservancy or successor in interest would work with USFWS to incorporate predator management into the overall management of the restoration site.

Impact BIO-31: Potential Harm to Marine Mammals and Special-Status Fish Species due to Pile-Driving Activities for Off-Loader Facility and Booster-Pump Platforms

The dredged material off-loading facility and booster-pump platform might be built on piles. Pile-driving activities, if conducted, could disturb marine mammals and sensitive fish species near the platforms in San Pablo Bay. The piles that would be used are estimated to be approximately 36 inches wide (.91 meters). Based on the estimated amount of piles necessary, pile-driving activities could take approximately 1 month.

Harbor seals use Sisters Rocks (approximately 2,100 yards south of the location of the off-loading facility) and Castro Rocks, adjacent to the Richmond–San Rafael Bridge, (approximately 7,000 yards southeast) as haul-out sites for resting and breeding. Castro Rocks is the largest haul-out site in the North Bay and the second largest breeding site in the San Francisco Bay. Harbor seals also use Lower Tubbs Island as a haul-out site (approximately 11,000 yards northeast of the approximate off-loading facility). Several special-status fish species are known to occur or have the potential to occur in the vicinity of the proposed expansion area, including longfin smelt; Central Valley and Central Coast steelhead; winter-run, spring-run, and fall-run chinook salmon; and coho salmon.

Because pile-driving studies have not been completed for equipment of the size proposed for this project, this analysis is based on the results of the pile installation demonstration project (PIDP) that was conducted for the San Francisco–Oakland Bay Bridge East Span Seismic Safety Project (East Span Project) (Caltrans 2001a, 2001b). Caltrans evaluated impacts to marine mammals and special-status fish species resulting from large pile-driving hammers (rated 500 to 1,700 kilojoules [kJ]) (Caltrans 2001a, 2001b). The hammers studied in the PIDP were far larger than the equipment that would be used for this project (estimated to be rated 110 to 220 kJ). Hammers delivering up to 200 kJ are commonly used for marine and near-shore construction around the Bay.

The PIDP for the East Span Project did not identify any apparent effect of pile driving on the Yerba Buena harbor seal haul-out site, which was located approximately 1 mile from the pile-driving activity. Because the nearest haul-out sites are both located more than 1 mile from the approximate location of the HWRP off-loading facility and booster-pump platforms, and the PIDP studied far more powerful pile-driving hammers, pile-driving activity at the platforms is not expected to affect the identified haul-out sites.

Pile-driving activity may disturb harbor seals or other marine mammals swimming in the immediate vicinity of the activity. NMFS considers in-air noise levels below 85 decibels (dB) safe for marine mammals, but the pile-driving activity is likely to result in in-air noise levels in excess of 85 dB. NMFS has determined that elevated underwater sound pressure levels (SPLs) of 180 to 190 dB or higher could cause temporary hearing impairment or threshold shifts in marine mammals, thus disrupting their behavior. In the PIDP for the East Span Project, the 190 dB contour for hammer energy level of 750 kJ was calculated as 185 meters. While not specifically studied, it is reasonable to assume that the 190 dB contour for the pile-driving equipment likely to be used for the HWRP would be far less than 185 meters. Marine mammals in the water in the immediate vicinity of the piles for the proposed expansion would be temporarily displaced if they choose to avoid the area in response to high sound pressure levels. While the specific sound pressure levels of the equipment proposed for pile-driving activity for this project have not been studied, it is assumed that the SPLs may reach or exceed the 190 dB contour, at least in the immediate vicinity of pile-driving activity. This impact is considered potentially significant. Implementation of Mitigation Measure BIO-13 would reduce these impacts. However, even with mitigation, there is the potential for harassment of marine mammals if an individual were to swim immediately adjacent to pile-driving activity. This impact is therefore considered significant and unavoidable, if pile-driving is used.

The PIDP for the East Span Project also documented fish mortality due to contraction and expansion of the swim bladder in an immediate mortality zone approximately 10 to 12 meters from the pile-driving activity. A delayed mortality zone, wherein injury was identified to the inner ear or other fish organs that may result in mortality several hours to several days after injury, was

estimated to be located in a radius of at least 150 meters and possibly as large as 1,000 meters (Caltrans 2001b).

While population-level impacts to fish are not expected, pile-driving activity may result in individual mortality in fish species present in the immediate vicinity of pile-driving. This impact is considered potentially significant. Implementation of Mitigation Measure BIO-13 would reduce this impact. However, even with mitigation, there is the potential for individual mortality in listed fish species immediately adjacent to pile-driving activity. This impact is considered significant and unavoidable, if pile-driving is used.

Mitigation Measure BIO-13: Coordinate with Appropriate Federal and State Agencies to Reduce Impact on Marine Mammals and Special-Status Fish Species during Pile-Driving Activities.
The Conservancy, Corps, or successors in interest will consult with NMFS and CDFG in order to implement measures to reduce impacts associated with pile-driving activities to marine mammals and special-status fish species. These measures could include but are not limited to the following.

- Scheduling pile-driving activities to occur outside the peak juvenile outmigration periods for chinook and steelhead salmon whenever possible.
- Monitor marine mammals during pile-driving activity, ceasing pile-driving activity temporarily if marine mammals approach within 100 meters.
- Monitor sound attenuation.

Impacts and Mitigation Measures Unique to Alternatives 1 and 2

Figures 3-1 and 3-2 (in chapter 3 of this document) illustrate the distribution of habitats restored, 50 years after implementation of the proposed BMKV expansion, under Alternative 1. Figures 3-3 and 3-4 (in chapter 3 of this document) illustrate the distribution of habitats restored, 50 years after implementation of the proposed BMKV expansion, under Alternative 2. Table 4-7 presents a comparison between the estimated extent of habitats restored under Alternatives 1 and 2 at year 50 and the expected net change in the extent of habitats relative to the No-Action Alternative (i.e., existing conditions).

Impact BIO-32: 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 out-migration (smolts of these species could be present in San Pablo Bay from about January 1 to June 30). These species could face mortality 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 from 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, and no mitigation is required.

Impact BIO-33: 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 pipelines across part of San Pablo Bay from hydraulic off-loaders, also located in the Bay. This process could increase the turbidity surrounding the hydraulic off-loaders and create the potential for fuel spills, thereby causing a disturbance to the fish species in the area. Fish are likely to move out of the area, however, until the water quality increases. All construction activities must meet the objectives established by the San Francisco RWQCB. However, drawing of water to use in slurry of dredged material pumped to the expansion site may result in fish entrainment. To further reduce the likelihood of fish entrainment or if resource agencies determine it to be necessary, the Conservancy or successor in interest would implement Mitigation Measure BIO-14.

Mitigation Measure BIO-14: Use Fish Screens to Prevent Possible Entrainment of Fish.
The Conservancy, Corps, or successors in interest will install fish screens or other appropriate fish exclusion devices to prevent entrainment of fish into the water intakes of the hydraulic off-loader pump. Fish screens or other exclusion devices will be designed to ensure intake velocities do not result in the impingement of fish onto the screen or result in other scenarios which harm fish.

Impacts and Mitigation Measures Unique to Alternative 1

Impact BIO-34: Disruption of Sensitive Wildlife due to Bay Trail Construction, Alternative 1 and Spur Option 1A

The Bay Trail would be constructed through the wetland/riparian area at the confluence of Arroyo San Jose and Pacheco Creek, where they enter Pacheco Pond, then along the Marin County Flood Control service road around the west side of Pacheco Pond (see figure 3-1 in chapter 3 of this document). From this point, the trail would be routed through the wetlands area on the west side of

Pacheco Pond and would cross the channel via bridge to Bel Marin Keys Boulevard.

Construction would require extensive in-water work and permanent loss of wetland/riparian areas along the route. Across the Arroyo San Jose/Pacheco Creek confluence, assuming a 50-foot width of disturbance, construction could result in loss of approximately 0.8 to 1.7 acres of wetlands depending on trail route. Construction along the western edge of the wetlands near Bel Marin Keys Boulevard could result in additional loss of approximately 1.1 acres of wetlands, assuming a 50-foot width of disturbance. Permanent loss would depend on the width of boardwalk or bridge structures utilized. In-water work could affect aquatic and riparian species found in and adjacent to the proposed route and could temporarily increase sedimentation and turbidity in Pacheco Pond. Construction noise and activity could also affect foraging and breeding behavior of fish and wildlife species that utilize Pacheco Pond and the lower portions of the 2 feeding creeks.

Placement of a trail through the wetland/riparian area at the southwest end of Pacheco Pond would create a physical disruption to the existing wetland/pond interface or within the wetland/riparian area, depending on routing. The trail would require at least 1 and possibly 2 or more bridge segments in the confluence area and an approximately 200-foot bridge to reach Bel Marin Keys Boulevard across the outlet channel of Pacheco Pond.

Spur Option 1A would be constructed on areas previously disturbed by other site preparation and construction. Construction of the trail itself, if it occurred before wetland creation/levee breaching, would not be expected to result in any additional impacts to sensitive wildlife beyond those already described for general site construction activities. If trail construction were to occur after restored wetlands have established or begun to be established, then the mitigation proposed above, including Mitigation Measures BIO-1, 3, 4, 5, and 6, will be applied to trail-construction activities. With implementation of this mitigation, the construction impact of Spur Option 1A is considered less than significant.

Given the presence of wetland, riparian, and aquatic environments along the potential route, the impact of construction of the Bay Trail west of Pacheco Pond is considered significant. Mitigation Measures BIO 1, 3, and 5, described above, are recommended as mitigation for this alternative. In addition, Mitigation Measure BIO-15 is recommended for this alternative.

Mitigation Measure BIO-15: Implement Specific Design and Management Recommendations for Construction of Trail West of Pacheco Pond.

The following will be incorporated into construction plans if the Bay Trail route under Alternative 1 is implemented.

- Contribute to future riparian restoration efforts on Pacheco Creek or Arroyo San Jose Creek in a manner sufficient to offset loss of riparian habitat brought about by construction and installation of trail across confluence.
- Carry out construction outside of the peak breeding seasons of sensitive species (such as Saltmarsh Common Yellowthroat) and migratory waterfowl, in consultation with DFG and USFWS.
- Minimize use of fill as foundations for bridge and boardwalk structures in wetland areas, where feasible.
- Incorporate best management practices during construction to prevent sedimentation of the wetland areas.
- Provide design plans to DFG and USFWS prior to construction to determine any additional mitigation necessary to reduce impacts on species using confluence area and Pacheco Pond.

Impact BIO-35: Disruption of Sensitive Wildlife due to Public Access Interactions along Bay Trail, Alternative 1

The Bay Trail under Alternative 1 would be adjacent to the open water and wetland habitat of Pacheco Pond and would be within the riparian/wetland habitat at the confluence of Pacheco Creek and Arroyo San Jose. No separation between the trail and the riparian/wetland habitat is possible, unless the trail is moved onto a boardwalk across the open water area of Pacheco Pond, the feasibility of which is unknown. The route along the existing service road would be near the western edge of Pacheco Pond and associated wetlands. The route north from the end of the service road to Bel Marin Keys Boulevard would be on a boardwalk over the wetlands adjacent to the Pond outlet. Given the proximity of the trail route to these environments, the feasibility and efficacy of buffering approaches is limited.

Lacking buffers or separation, public access is more likely to disrupt wildlife use of immediately adjacent environments around Pacheco Pond. In particular, bird breeding activity in and adjacent to Pacheco Pond would be affected by public access.

Given the presence of wetland, riparian, and aquatic environments immediately adjacent to the potential route, the impact of access is likely to be significant. Mitigation Measures BIO-12, BIO-16a, and BIO-16b would be necessary to reduce this impact to a less-than-significant level.

Mitigation Measure BIO-16a: Implement Specific Design and Management Recommendations for Bay Trail Alternative 1.

The following will be incorporated into the design and trail management plan if the Bay Trail route in Alternative 1 is implemented.

- Place physical buffers (such as vegetation), barriers (such as fencing), or periodic signage between the trail and Pacheco Pond, where appropriate and necessary.
- Prohibit all dog access.
- Prohibit fishing and boating access from the trail to Pacheco Pond (fishing, swimming, and boating are presently prohibited at the pond).
- Establish seasonal closures of the trail spur during peak breeding seasons of sensitive species (such as Saltmarsh Common Yellowthroat) or other species that use the confluence area, in consultation with DFG and USFWS.

Mitigation Measure BIO-16b: Implement Specific Design and Management Recommendations for Spur Option 1A.
The following will be incorporated into the design and trail management plan if Spur Option 1A is implemented.

- Locate trail a minimum of 300 feet from tidal marsh habitat.
- Locate trail on the northern slope of the central crossing levee to avoid direct visual and physical proximity to restored tidal wetlands areas. Provide periodic point access to the top of the levee for visual access.
- Place physical buffers (such as vegetation), barriers (such as fencing), or periodic signage, where appropriate and necessary, between the trail and the tidal marsh habitat and between the trail and Pacheco Pond
- Impose gated access to prevent public access to the NSD access road/berm between BMKV and the HAAF site.
- Place a physical barrier of fencing or other suitable material between the trail and Novato Creek to prevent all access to the creek from the trail.
- Monitor wetland restoration development to determine if and when California Clapper Rails, California Black Rails, or other sensitive bird species begin using restored tidal marsh for breeding.
- Establish seasonal closures of the trail spur during peak breeding seasons of the California Clapper Rail and California Black Rail. Consider additional seasonal closures for other special-status species (such as Saltmarsh Common Yellowthroat and San Pablo Song Sparrow), in consultation with DFG and USFWS.
- Prohibit dog access along the spur trail.
- Prohibit fishing and boat access from trail terminus to Novato Creek and from Novato Creek to trail.

Impacts and Mitigation Measures Unique to Alternative 2

Impact BIO-36: Disruption of Sensitive Wildlife due to Bay Trail Construction, Alternative 2 and Spur Option 2A

The Bay Trail under Alternative 2 would be located along the levee between Pacheco Pond and the HAAF site, along the levee between Pacheco Pond and the BMKV expansion area, and across upland areas leading to Bel Marin Keys Boulevard (see figure 3-3 in chapter 3 of this document). Spur Option 2A would add a trail from the east side of Pacheco Pond to Novato Creek on the central crossing levee.

Because the Bay Trail route under this alternative would be constructed on areas previously disturbed by other site preparation and construction, construction of the trail itself and Spur Option 2A, if it occurred before wetland creation/levee breaching, would not be expected to result in any additional impacts to sensitive wildlife beyond those already described for general site construction activities. If trail construction were to occur after restored wetlands have established or begun to be established, then the mitigation proposed above, including Mitigation Measures BIO-1, 3, 4, 5, and 6, should be applied to trail-construction activities. With implementation of this mitigation, as necessary, this impact is considered less than significant.

Impact BIO-37: Disruption of Sensitive Wildlife due to Bay Trail Access, Alternative 2 and Spur Option 2A

The Bay Trail under Alternative 2 would be adjacent to the western side of the HAAF parcel, Pacheco Pond, the BMKV seasonal wetland restoration area, and upland areas. Spur Option 2A would add a trail adjacent to the BMKV tidal wetland restoration and to Novato Creek. This proximity may create public access conflicts with sensitive wildlife as discussed above.

Mitigation Measure BIO-12, BIO- 17a and BIO-17b would be necessary to reduce this impact to a less-than-significant level.

Mitigation Measure BIO-17a: Implement Specific Design and Management Recommendations for Bay Trail Alternative 2.

The following will be incorporated into the design and trail management plan if the Bay Trail under Alternative 2 is implemented.

- Place physical buffers (vegetation), barriers (such as fencing), or periodic signage) between the trail and Pacheco Pond and between the trail and the restored seasonal wetland area, as appropriate and necessary.

- Impose gated access to prevent public access to the NSD access road/berm between BMKV and the HAAF site.
- Prohibit all dog access.
- Prohibit fishing and boating access from the trail to Pacheco Pond (fishing, swimming, and boating are presently prohibited at the pond).

Mitigation Measure BIO-17b: Implement Specific Design and Management Recommendations for Spur Option 2A.
The following will be incorporated into the design and trail management plan if Spur Option 2A is implemented.

- Locate trail a minimum of 300 feet from tidal marsh habitat.
- Locate trail on the northern slope of the central crossing levee to avoid direct visual and physical proximity to restored tidal wetlands areas. Provide periodic point access to the top of the levee for visual access.
- Place physical buffers (vegetation), barriers (such as fencing), or periodic signage) between the trail and the tidal marsh habitat as appropriate and necessary. Place a physical buffer of fencing between the trail and Novato Creek to prevent all access to the creek from the trail.
- Monitor wetland restoration development to determine if and when California Clapper Rails, California Black Rails or other sensitive bird species begin using restored tidal marsh for breeding.
- Establish seasonal closures of the trail spur during peak breeding seasons of the California Clapper Rail and California Black Rail. Consider other seasonal closures for other special-status species (such as Saltmarsh Common Yellowthroat and San Pablo Song Sparrow), in consultation with DFG and USFWS.
- Prohibit dog access along the spur trail.
- Prohibit fishing and boat access from the trail to Novato Creek and from Novato Creek to the trail.

Impacts and Mitigation Measures Unique to Alternative 3

Impact BIO-38: Disruption of Sensitive Wildlife due to Bay Trail Construction, Alternative 3 and Spur Option 3A

The Bay Trail under Alternative 3 would be located along the levee between Pacheco Pond and the HAAF parcel, along the levee around the east side of the expanded Pacheco Pond, and across upland areas leading to Bel Marin Keys Boulevard (see figure 3-5 in chapter 3 of this document). Spur Option 3A would add a trail from the east side of Pacheco Pond to Novato Creek on the new levee south of the BMK south lagoon levee.

Because the Bay Trail route under this alternative and Spur Option 3A would be constructed on areas previously disturbed by other site preparation and construction, construction of the trail itself or Spur Option 3A, if it occurred before wetland creation/levee breaching, would not be expected to result in any additional impacts to sensitive wildlife beyond those already described for general site construction activities. If trail construction were to occur after restored wetlands have established or begun to be established, then the mitigation proposed above, including Mitigation Measures BIO-1, 3, 4, 5, and 6, should be applied to trail-construction activities. With implementation of this mitigation, as necessary, this impact is considered less than significant.

Impact BIO-39: Disruption of Sensitive Wildlife due to Bay Trail Access, Alternative 3 and Spur Option 3A

The Bay Trail under Alternative 3 would be adjacent to the HAAF site, the expanded Pacheco Pond, and upland areas. Spur Option 3A would be adjacent to the BMKV tidal wetland restoration and to Novato Creek. This proximity may create public access conflicts with sensitive wildlife as discussed above. Spur Option 3A would place a trail closer to the restored tidal wetland than in either of the other 2 alternatives because there is no upland buffer on the outboard side of the new levee.

Mitigation Measures BIO-12, BIO- 18a, and BIO 18b would also be necessary to reduce this impact to a less-than-significant level.

Mitigation Measure BIO-18a: Implement Specific Design and Management Recommendations for Bay Trail Alternative 3.

The following will be incorporated into the design and trail management plan if the Bay Trail Alternative 3 is implemented.

- Locate trail on the eastern slope of the expanded Pacheco Pond levee to avoid direct, constant physical proximity to Pacheco Pond. Provide periodic point access to the top of the levee for visual access.
- Place physical buffers (such as vegetation), barriers (such as fencing), or periodic signage between the trail and the expanded Pacheco Pond, as appropriate and necessary.
- Impose gated access to prevent public access to the NSD access road/berm between BMKV and the HAAF site.
- Prohibit all dog access.
- Prohibit fishing and boating access from the trail to Pacheco Pond (fishing, swimming, and boating are presently prohibited at the pond).

Mitigation Measure BIO-18b: Implement Specific Design and Management Recommendations for Trail Spur Option 3A.
The following will be incorporated into the design and trail management plan if Option 3A is implemented.

- Locate trail a minimum of 300 feet from existing and future tidal marsh habitat.
- Locate trail on the western slope of the levee that is south of the BMK south lagoon levee to avoid direct visual and physical proximity to restored tidal wetlands areas. Provide periodic point access to the top of the levee for visual access.
- Place physical buffers (such as vegetation), barriers (such as fencing), or periodic signage between the trail and the tidal marsh habitat, as appropriate and necessary. Place a physical buffer of fencing or other suitable material between the trail and Novato Creek to prevent all creek access from the trail.
- Monitor wetland restoration development to determine if and when California Clapper Rails, California Black Rails, or other sensitive bird species begin using restored tidal marsh for breeding.
- Establish seasonal closures of the trail spur during peak breeding seasons of the California Clapper Rail and California Black Rail. Consider additional seasonal closures for other special-status species (such as Saltmarsh Common Yellowthroat and San Pablo Song Sparrow), in consultation with DFG and USFWS.
- Prohibit dog access along the spur trail.
- Prohibit fishing and boat access from trail terminus to Novato Creek and from Novato Creek to the trail.

Land Use and Public Utilities

Affected Environment

Data Sources

The following documents and policies were used to prepare this section.

- *Marin Countywide Plan and Marin County Zoning Code* (Marin County Community Development Agency 1994)
- *City of Novato General Plan* (City of Novato 1996)
- *Bay Trail Plan* (Association of Bay Area Governments 1989)
- *Long-Term Management Strategy Plan* (1996)
- *San Francisco Bay Area Wetlands Ecosystem Goals Project* (1998)

- *San Francisco Bay Plan* (San Francisco Bay Conservation and Development Commission 1969)
- Coastal Zone Management Act

Land Ownership

Land ownership in the vicinity of the proposed expansion is described below. If development associated with the BMKV expansion is carried out on lands not owned by the project sponsors, owner approval will be required prior to implementation of any development activities.

Federal and State Ownership

The BMKV expansion site is owned by the Conservancy. The SLC parcel is owned by the State Lands Commission. The HAAF parcel is owned by the Corps.

Local and Private Ownership

Pacheco Pond is owned by MCFCWCD. The City of Novato owns portions of Ammo Hill and the Bay Trail. Headquarters Hill is under private ownership.

Regulatory Setting

Marin Countywide Plan

The Marin Countywide Plan (MCP) is a long-range comprehensive plan that governs growth and development in the unincorporated areas of the county. The proposed BMKV expansion site falls within this jurisdiction. The county land use designations relevant to the expansion site are discussed in a separate section below. Flood zoning is discussed separately in the *Surface Water Hydrology and Tidal Hydraulics* section.

Key relevant policies and programs governing land uses on the expansion site are listed below.

- **Policy EQ-2.42: Wildlife and Aquatic Habitats.** The County shall preserve and enhance the diversity of wildlife and aquatic habitats found in the Marin County bayfront lands, including tidal marshes, seasonal marshes, lagoons, wetlands, agricultural lands, and low-lying grasslands overlying historical marshlands.

- **Policy EQ-2.43: Development and Access Limitations in Bayfront Conservation Areas.** Development shall not encroach into sensitive wildlife

habitats, limit normal range areas, create barriers which cut off access to food, water, or shelter, or cause damage to fisheries or fish habitats. Buffer zones between development and identified or potential wetland areas shall be provided. Access to environmentally sensitive marshland and adjacent habitat shall be restricted, especially during spawning and nesting seasons.

- Program EQ-2.43a: Wetland Impact Mitigation. Development should be sited to avoid wetland areas so that the existing wetlands are preserved. The next priority would be to restore or enhance the wetland environment on-site, provided that no net loss of wetlands occurs. Restoration of wetlands off-site should only be allowed when it has been demonstrated that on-site restoration is not possible and there is no net loss of wetlands. For each acre of wetland lost, two acres shall be restored and should be of the same type of wetland habitat as the wetland which was lost.

- Program EQ-2.43b: Reduce Impacts to Wetlands. All technically feasible measures will be taken to reduce impacts and losses to the original wetland.

- **Policy EQ-2.45: Diked Historic Marshlands Subzone.** The County shall through its land use and development regulations, foster the enhancement of the wildlife and aquatic habitat value of the diked historic marshlands subzone. Land uses which provide or protect wetland or wildlife habitat, and which do not require diking, filling, or dredging, shall be encouraged. These uses include, but are not limited to restoration to tidal status; restoration to seasonal wetlands; agricultural use; flood basin and wastewater reclamation area. In addition, other uses which do not require diking, filling, or dredging, may be allowed if such uses are consistent with the zoning designation and it can be demonstrated that impacts to the bayfront environment are minimized and mitigated. When development is proposed, priority should be given to water oriented uses such as public access and low intensity passive recreational and educational opportunities.

- **Policy EQ-2.49: Planned District Development Review with Environmental Assessment.** The County shall review all proposed development within the Bayfront Conservation Zone in accordance with the planned district review procedure in order to ensure maximum possible habitat restoration and protection. An Environmental Assessment of existing environmental conditions (biologic, geologic, hazard, and aesthetic) shall be required prior to submittal of development plans.

- **Policy EQ-2.50: Coordination with Trustee Agencies within Bayfront Conservation Areas.** The County shall facilitate consultation and coordination with the trustee agencies (Department of Fish and Game, U.S. Fish and Wildlife Service, the Corps of Engineers, EPA, Regional Water Quality Control Board, and BCDC) during environmental review and during review of other proposals for lands within the Bayfront Conservation Zone.

- **Policy EQ-2.51: Minimal Impacts Within Bayfront Conservation Zone.** The County shall ensure that development in the County occurs in a manner which minimizes the impact of earth disturbance, erosion, and water pollution within the Bayfront Conservation Zone.

- **Policy EQ-2.58: Protection of Existing Agricultural Lands.** The County shall protect existing agricultural lands in the Bayfront Conservation Zone. These lands are identified as an important resource for the County because they are a visual and scenic resource; play an integral role in other agricultural and dairy operations in Marin County; are a productive economic resource; and are compatible with water-related wildlife habitat. Such agricultural activities could consist primarily of grazing operations and crop production harmonious with adjoining marshes, wetlands, grasslands, or other sensitive lands. Agricultural lands provide habitat for many wildlife species. These habitats may be important for migratory species during times of flood and after silage has been cut.

- **Policy EQ-2.67: Ensuring Public Access of Shoreline Areas.** The County shall ensure that public access is provided and protected along the bayfront and significant waterways. Public access should be allowed only where access can be accommodated without damaging wildlife habitat.

City of Novato General Plan

The City of Novato General Plan is a comprehensive long-range planning document that identifies the city's land use, transportation, environmental, economic, fiscal, and social goals and policies as they relate to the conservation and development of land in Novato. The SLC parcel is located within the City of Novato. Portions of the Bay Trail routes west of HAAF and BMKV are within the City of Novato. Key policies related to the site include:

- **EN Policy 11 Bayland Overlay Zone.** Establish a Bayland Overlay Zone to preserve and enhance natural and historic resources, including wildlife and aquatic habitats, tidal marshes, seasonal marshes, lagoons, wetlands, agricultural lands and low-lying grasslands overlaying historic marshlands.

- **EN Policy 12 Bayland Area Protection.** Regulate development in the Bayland Overlay Zone so that it does not encroach into wetlands or sensitive wildlife habitats, provided that this regulation does not prevent all use of a property. Discourage human activity that damages fisheries, or habitat for birds, fish or other wildlife.

- **EN Policy 13 Views.** Encourage protection of visual access to the San Pablo Bay Shoreline and the Petaluma River.

- **EN Policy 14 Tidal Areas.** Cooperate with State and Federal agencies to ensure that areas subject to tidal action remain in their natural state.

- **EN Policy 16 Public Access and Water-oriented Uses.** Encourage public access to shoreline areas, consistent with wildlife and habitat protection and safety considerations. Allow water-oriented uses such as public access, docks and piers, and low-intensity recreational and educational activities which provide or protect wetland or wildlife habitat, and which do not require diking, filling, or dredging. Encourage restoration to tidal status, and seasonal wetlands. Allow use of shoreline areas for flood basins, and wastewater reclamation.

- **EN Policy 50 Integrated Trails System.** Facilitate the development of an integrated trails system that connects regional trails, schools, open space, parks, recreation facilities, and residential areas.

Bay Trail

ABAG developed the Bay Trail Plan (Association of Bay Area Governments 1989) as a framework for the implementation of the Bay Trail project. The Bay Trail Plan's main goal is to ensure the provision of public access to the Bay and its surrounding lands. The Bay Trail is a planned recreation corridor that will provide some 400 miles (640 kilometers) of biking and hiking trails when it is complete. A proposed segment of the Bay Trail follows Perimeter Road, located on the levee that separates the expansion site from the HAAF site, and connects with Bel Marin Keys Boulevard. This segment would connect to an existing trail that connects with Highway 37.

In addition to the Bay Trail Plan, the Marin Countywide Plan and City of Novato General Plan also include provisions on the Bay Trail. The Marin Countywide Plan Trails Elements shows the Bay Spine Trail along the Golden Gate Bridge Highway Transit District (GGBHTD) right-of-way and the Bay Spur Trail along the bayfront levee in the HAAF area, which is consistent with the current City of Novato General Plan. The plan also shows a continuous bayfront trail from HAAF north to the existing side of Headquarters Hill (Questa Engineering Corp 2001).

The City of Novato general plan includes the following program policy regarding the Bay Trail:

> Work with the Marin County Open Space District and ABAG to implement the trail system described in the Marin Countywide Plan and the Bay Trail Plan (City of Novato 1996).

The Bay Trail route as delineated in the Novato general plan shows the trail as being located along the eastern edge of Pacheco Pond. The general plan shows the trail going around the western side of Headquarters Hill near Bel Marin Keys Boulevard.

Long-Term Management Strategy and Long-Term Management Plan

In 1990, the federal EPA, Corps, BCDC, SWRCB, RWQCB, SLC, and private stakeholders established the Long-Term Management Strategy (LTMS) for material dredged from San Francisco Bay. The federal EPA, Corps, BCDC, SWRCB, and RWQCB cooperatively implement the LTMS.

The goals of the LTMS are to

- conduct dredging and the disposal of dredged material in an environmentally and economically sound manner,
- develop a permit review process, and
- maximize the beneficial reuse of dredged materials.

These goals provide the foundation for the continuing management plan.. The LTMS management plan identifies 22 existing and potential locations for reuse and placement of dredged materials, 1 of which is the proposed wetland restoration site. One of the goals of the LTMS management plan is to reduce in-Bay disposal of dredged material by 1.5 million cubic yards over the next decade.

San Francisco Bay Area Wetlands Ecosystem Goals Project

The San Francisco Bay Area Wetlands Ecosystem Goals Project (Goals Project) was a 5-year volunteer collaborative effort completed in 1998. Sponsored by a group of agencies that included EPA, DFG, and RWQCB, it involved more than 100 scientists from federal, state, and local agencies, as well as private consulting firms and universities. The results of the Goals Project address a 9-county area that encompasses the entire estuary downstream of the Delta.

The Goals Project is intended to provide guidance to public and private stakeholders interested in restoring and enhancing the wetlands and related habitats of the San Francisco Bay estuary system. It is an informational document that recommends the types, areal extent, and distribution of habitats needed to sustain diverse and healthy ecosystems in the San Francisco Bay estuary. Recommendations are presented by region, subregion, and segment. Region-wide goals include the restoration of large patches of tidal marsh connected by corridors to enable the movement of small mammals and marsh-dependent birds, the restoration of large complexes of salt ponds for the management of shorebirds, and the expansion of large areas of managed marsh. The BMKV and SLC sites are identified in this plan as key areas for tidal marsh restoration.

McAteer–Petris Act, San Francisco Bay Plan, and Coastal Zone Management Act

The McAteer–Petris Act, passed by the State of California in 1965, established BCDC as the state agency responsible for regulating development in and around San Francisco Bay and directed BCDC to undertake the planning effort that resulted in the development of the San Francisco Bay Plan. The Bay Plan describes the values associated with the Bay and presents policies and planning maps to guide future uses of the Bay and its shoreline. Under the Bay Plan the priorities for suitable uses of the shoreline are ports, water-related industry, airports, wildlife refuges, and water-related recreation. The Bay Plan also proposes to add land to the Bay refuge system; encourages public access via marinas, waterfront parks, and beaches; and requires the provision of maximum access along the Bay shorelines—except where public uses conflict with other significant uses or where public use is inappropriate because of safety concerns.

The San Francisco Bay Plan was prepared to guide the future protection and use of the San Francisco Bay and its shoreline. The Bay Plan maps designate the HAAF and SLC sites for wildlife priority use and include a map note for the sites that states that the Bay Plan policy is to: "…develop comprehensive wetlands habitat plan and long-term management program for restoring and enhancing wetlands habitat in diked former tidal wetlands. Dredged materials should be used whenever feasible and environmentally acceptable to facilitate wetlands restoration." Furthermore, the BMKV expansion site is recommended for "possible use as a wetland restoration site using dredged material."

The federal Coastal Zone Management Act of 1972 encourages states to voluntarily develop CMPs to preserve and protect the unique features of each coastal area. BCDC is the state coastal management agency for the San Francisco Bay segment of the coastal zone, and its laws and policies constitute the federally approved state coastal management program for the Bay.

Farmland Conservation Regulations

Three major programs regulate or monitor the development and conversion of farmlands in California. These are the federal Farmland Protection Policy Act (FPPA) , the state Farmland Mapping and Monitoring Program, and the California Land Conservation Act (Williamson Act), which operates at the county level. The following summarize key aspects of each program.

Farmland Protection Policy Act

The FPPA of 1984 requires federal agencies to consider how their activities or responsibilities that involve financing or assisting construction of improvement projects, or acquiring, managing, or disposing of federal land and facilities may affect farmland. To comply with the provisions of the FPPA, the lead federal agency must consult with the NRCS and complete a land evaluation and site assessment (LESA) for each affected site or area. The federal lead agency is

responsible for coordinating completion of the Farmland Conversion Impact Rating Form (Form AD-1006) with the NRCS.

Under the LESA system, proposed project sites receive scores based on several criteria, including soil quality and existing land use. The highest possible score for a site is 260 points. If a proposed federal action would affect a site that has been rated with a score $\geq$160, alternative sites should be considered.

Farmland Mapping and Monitoring Program

As part of its Farmland Mapping and Monitoring Program, the California Department of Conservation (DOC) periodically prepares maps of important farmlands for most of the state's agricultural areas. Preparation of these maps follows DOC's Important Farmland Inventory (IFI) system, which relies on the following sources of information.

- NRCS (formerly SCS) soil survey maps
- Land inventory and monitoring criteria developed by NRCS to characterize the land's suitability for agricultural production, the physical and chemical characteristics of its soil, and the actual (existing) land use
- Land use information mapped by the California Department of Water Resources (DWR)
- Important farmland maps, typically updated every 2 years

The important farmland mapping system defines 4 categories of farmlands and 3 categories of lands used for non-agricultural purposes. Following are the 4 farmland mapping categories.

Prime Farmland – Lands with a combination of physical and chemical features best able to sustain long-term production of agricultural crops. The land must be supported by a developed supply of irrigation water that is dependable and of adequate quality during the growing season. It must also have been used for the production of irrigated crops at some time during the 4 years before mapping data were collected.

Farmland of Statewide Importance – Lands with agricultural land use characteristics, irrigation water supplies, and physical characteristics similar to those of prime farmland but with minor shortcomings, such as steeper slopes or soils that retain less moisture.

Unique Farmland – Lands with soils of lower quality used for the production of California's leading agricultural cash crops. Unique farmlands are typically irrigated but include non-irrigated orchards or vineyards in some of the state's climatic zones.

Farmland of Local Importance – Lands of importance to the local agricultural economy, as determined by each county's board of supervisors and a local advisory committee.

California Land Conservation Act (Williamson Act)

The California Land Conservation Act (Williamson Act) is one of the state's primary mechanisms for conserving farmland. This voluntary program is administered at the county level and offers landowners property tax incentives to maintain their lands in agriculture or other compatible uses. Under the Williamson Act, private landowners may enter into a contract with their county, limiting the use of their land to agriculture or other compatible use for a minimum period of 10 years. In return, the county assesses the land at its agricultural value rather than its fair market value. This limits property tax increases that could otherwise arise from land speculation.

Land Uses, Zoning, Easement, Utilities, and Farmland Designations in the Expansion Area

Land Use and Zoning

The BMKV site consists of former baylands that were diked for agricultural use in the late 19th century. Recently, the majority of the site has been under cultivation for oat hay. Two fields were authorized in the1980s for the placement of dredged materials and have subsequently been left fallow (figure 4-9).

The BMKV site is located within the City-Centered Corridor planning area of Marin County and is designated for agriculture and conservation use, with a permitted residential use of 1 unit per 2–10 acres (RSP 0.5).

The BMKV site is zoned within the Bayfront Conservation Zone. This zone is intended to preserve, protect, and enhance existing species and habitat diversity in the county.

The majority of the proposed wetland restoration site is zoned BFC–RSP 0.5 (Bayfront Conservation – Residential, Single-Family Planned 1 unit/2acres) and the remainder is zoned BFC–ARP 2 (Bayfront Conservation – Agricultural, Residential, Planned 1 unit/ 2 acres) (figure 4-10). Existing land use designations and zoning support agricultural and open space uses and restoration of agricultural land to wildlife habitat and/or wetlands. Planned single-family residential development with a density of 0.5 unit per acre is also permitted. However, in part because of the need to balance the requirements of the natural and built environments within the Bayfront Conservation Zone, the county does not guarantee approval of the maximum housing density permitted by existing zoning; actual approvals would be contingent on the results of environmental compliance documentation for proposed development projects (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998).

Flood zoning is discussed separately in the *Surface Water Hydrology and Tidal Hydraulics* section.

Easements

Two utility easements cross the BMKV site. A 20-foot easement for the NSD outfall pipeline is located on the east side of the levee that separates the expansion site from the HAAF site. An easement for the PG&E transmission line and towers crosses the northern portion of the BMKV site, west and east of the BMK south lagoon.

BMK CSD has a number of easements on Conservancy-owned land. The Conservancy owns some of the land under the BMK south lagoon, including the land under the lock, and BMK CSD has easements for the drainage, navigation, and maintenance associated with the lagoon proper. The restoration project includes no actions on the lands under the south lagoon itself, so these easements would not be affected.

BMK CSD also has an easement for maintenance of the south lagoon levee. This 100-foot easement allows access for the maintenance of the south lagoon.

Several drainage agreements held by MCFCWCD and one drainage agreements held by BMK CSD are discussed separately in the *Surface Water Hydrology and Tidal Hydraulics* section.

Utilities

The utilities on the proposed wetland restoration site include 5 PG&E electric transmission line towers and the NSD sewer line. The 5 electric transmission line towers are located in the north-western and north-central portion of the expansion site, adjacent to Novato Creek and are located within a 40-foot wide easement. The NSD line is located on the BMKV side of the levee that separates the expansion site from the HAAF site.

Farmland Designations

The BMKV site received a score of 53 under the LESA system, well below the 160 LESA score at which alternative sites should be considered, because the site is poorly drained, has low fertility, and lacks a supply of irrigation water (Jones & Stokes 2001). The BMKV site has been identified as farmland of local importance. The BMKV site is not currently under Williamson Act contracts.

Land Uses Adjacent to the Expansion Site

Bel Marin Keys Residential Community

The marina residential area of BMK is located north of the expansion site and includes approximately 700 single-family homes located along 2 managed lagoons connected to Novato Creek by 2 locks (figure 4-9). The lagoons provide opportunities for recreational water sports and berthing for private watercraft. The south lagoon is contained by a levee located on property now owned by the Conservancy. Part of the south lagoon channel and the lock structure is also on lands owned by the Conservancy. The BMK CSD possesses easements for maintenance of the lagoon levee and for navigation purposes across the Conservancy-owned portions of the channel and lock. BMK boat owners use Novato Creek to access the Bay.

Headquarters Hill

Several private homes are located on Headquarters Hill adjacent to the northwest corner of the expansion site and adjacent to Bel Marin Keys Boulevard (figure 4-9). Headquarters Hill is not owned by the Conservancy and is not part of the proposed expansion.

Pacheco Pond

Pacheco Pond is located west of the proposed expansion site. This 120-acre site is a flood control reservoir that was constructed by the developer of the Ignacio Business Park and was deeded to MCFCWCD as a detention basin for flows from Pacheco Creek and Arroyo San Jose. Water from Pacheco Pond is currently discharged to Novato Creek. The Ignacio Business Park, which is a mixed-use office/light industrial/commercial development, is located west of Pacheco Pond (figure 4-9).

Novato Creek

Novato Creek is used for navigation by boats that are docked in the Bel Marin Keys south and north lagoons and can be used for recreation by boats that may access the creek from San Pablo Bay. Novato Creek is designated as a navigable water and a public way, from its mouth to Sweetzer's Landing, by the California Harbors and Navigation Code Section 104.

The form of the Novato Creek channel has been significantly altered by development in the lower watershed. Prior to agricultural development, the daily flow of tides in approximately 3,500 acres of wetland in the lower watershed maintained a much larger channel than currently exists. Since agricultural development, the creek has been cut off from wetlands that provided a large part of its tidal prism. Scouring flows have been reduced to approximately 3% of the historical tidal flow rate, which has caused the channel to contract in depth and

associated cross-sectional area. To mitigate the effects of reduced channel depth on navigation and flooding dynamics, sections of the lower reaches of Novato Creek have been dredged. From the mid 1960s to the late 1980s, navigation dredging by BMK CSD occurred on an approximately 10-year cycle. Within the lower tidal reaches of Novato Creek (i.e., BMK region and downstream), tidal conveyance represents the primary sediment source, delivering sediment to the creek by flood tides that contain suspended sediment from San Pablo Bay. Sedimentation rates and patterns in this reach are consistent with other tidally influenced channels in the North Bay (Philip Williams and Associates 2002)

Hamilton Army Air Field

The former HAAF is located south of the proposed expansion site. HAAF was decommissioned as an active Air Force facility in 1974. The parcel includes a former runway, aprons, taxiways, a revetment area, an airplane hangar, and other miscellaneous structures. The revetment area is located in the northeastern corner of the revetment turnouts. The HWRP is currently being planned for this site, in which tidal marsh and seasonal marsh will be restored (figure 4-9).

State Lands Commission Parcel

Land Use

The area that now makes up the SLC parcel was owned by the Air Force and was operated as part of HAAF until 1974. While the base was active, the parcel supported a variety of uses, including a rifle range, a pistol range, and antenna facilities. It was also used at various times for skeet shooting and firefighter training. Some infrastructure related to military uses remains onsite. When HAAF was decommissioned, the State of California acquired the parcel and leased a portion of the rifle range to the City of Novato for police small arms training (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998). Antennas and associated cables are also located in the area. Other facilities at the site include aboveground fuel tanks, transformers, target-practice ranges previously used by the Novato Police Department, and burn pits.

The City of Novato General Plan designates the SLC parcel as open space. It describes open space uses as "publicly-owned land that is largely unimproved and devoted to the preservation of natural resources, outdoor recreation, floodways and flood control, and the maintenance of public health and safety." The allowable uses within this land use category include uses devoted to the preservation of natural resources.

The SLC parcel is also located within an area zoned by the general plan as the Bayfront Area. The designated Bayfront Area was established to "preserve and enhance natural and historic resources, including wildlife and aquatic habitats, tidal marshes, seasonal marshes, lagoons, wetlands, agricultural lands, and low-lying grasslands overlaying historic marshlands."

Utilities

NSD has two 50-year easements on the SLC parcel: a 20-foot-wide easement for the outfall pipeline; and an easement for the dechlorination plant, which is located on the southern edge of the SLC parcel. Treated effluent is conveyed from the Ignacio Treatment Plant and the Novato Treatment Plant to the dechlorination plant through a 54-inch outfall force main located on the BMKV and SCL parcels, parallel to the HAAF perimeter levee. The treated effluent is dechlorinated and then discharged to San Pablo Bay. Power is supplied to the dechlorination plant through an underground power line that runs from a transformer at the perimeter ditch pump station along the outboard side of the HAAF levee. Water is brought to the dechlorination plant in trucks and is stored onsite. The HWRP would relocate the dechlorination plant to allow the wetland restoration effort to proceed on the SLC parcel.

Environmental Consequences and Mitigation Measures

Approach and Methods

Information related to land uses, utilities, and easements at the expansion site was reviewed and compared to the restoration alternatives to evaluate the potential for land use conflicts, disruption or loss of services provided by utilities, or conflicts with easements. Potential impacts were compared to the thresholds of significance described below to determine the level of significance of each impact.

Impact Mechanisms

The following impact mechanisms would affect the land use of the expansion site.

- Placing dredged material to create elevations suitable for tidal marsh restoration
- Creating public access along the Bay Trail or spurs to the Bay Trail
- Breaching the perimeter levee of the site to restore tidal connection to the site with San Pablo Bay and Novato Creek

Thresholds of Significance

The following significance criteria were used to evaluate the proposed BMKV expansion. Regarding land use and utilities, the proposed expansion was identified as resulting in a significant impact on the environment if it would

- conflict or be incompatible with the land use goals, objectives, or guidelines of applicable general plans;
- be inconsistent or conflict with statutes of the California Coastal Act or the land use goals, objectives, or policies of BCDC or other applicable state agencies;
- substantially conflict with an existing onsite land use;
- substantially conflict with existing or future adjacent land uses;
- result in the loss of an existing easement or service to existing facilities;
- conflict with existing regional utility infrastructure; and
- convert a large amount of prime farmland, unique farmland, or farmland of statewide importance to a non-compatible and/or non-agricultural use.

In general, permitted and adopted land uses in areas surrounding the expansion area are compatible with habitat restoration. Consequently, implementation of the habitat restoration is not generally expected to result in adverse effects on existing or planned land uses adjacent to the proposed wetland restoration site. However, habitat restoration would result in the impacts on land use described below.

Impacts and Mitigation Measures of No-Action Alternative

The No-Action Alternative would not result in any impacts to land uses on the expansion site. The proposed wetland restoration site would continue to support agricultural fields and utilities. The site would also continue to provide capacity for floodwater overflows from Novato Creek and Pacheco Pond.

Impacts and Mitigation Measures Common to Alternatives 1–3

Impact LU-1: Consistency with Applicable City and County General Plans and Policies

The proposed wetland restoration is generally consistent with applicable county policies that support the enhancement of the wildlife and aquatic habitat value of the diked historic marshlands in the Bayfront Conservation Zone along San Pablo Bay. County Policy EQ-2.42 encourages the County to preserve and enhance the diversity of wildlife and aquatic habitats found in bayfront lands. Policy EQ-2.45 encourages land uses which provide or protect wetland or wildlife habitat including restoration to tidal status and to seasonal wetlands.

Some of the MCP policies contain language discouraging any filling within the Bayfront Conservation Zone, however the language referring to potential filling is primarily in the context of fill for development, not for habitat enhancement. Alternatives 1 and 2 would require the placement of dredged material and all three alternatives would include construction of levees on the BMKV site. While these activities might be considered "fill", these activities are only proposed in the overall purpose of enhancing the wildlife and aquatic habitat value of the BMKV site and implementing the overall site design. Mitigation measures described above in the *Biological Resources* section are proposed to reduce adverse impacts resulting from such activities on existing habitat and the project overall would increase substantially the amount of wetland habitat at the site.

Implementation of any of restoration alternatives at the BMKV parcel would result in conversion of the existing agricultural lands, which would be inconsistent with MCP Policy EQ-2.58. This policy recognizes agricultural lands as important as a visual resource, as part of agricultural and dairy operations, as a productive economic resource, and as compatible with, and in some cases, providing wildlife habitat. As discussed below in the *Visual Aesthetics* section of this chapter, the restoration of tidal wetlands and other habitats on the site is expected to maintain or improve on the visual aesthetics of the BMKV site itself. As described below under impact LU-5, the agricultural land at the BMKV parcel is not designated prime farmland, unique farmland, or farmland of statewide importance, is a small portion of available Marin County agricultural land, and has not produced substantial crops to support the local agriculture economy. While agricultural land can be compatible with wildlife habitat, the restoration alternatives would provide a significant enhancement of the wetland and aquatic habitat of the site compared to the existing setting.

While the project would be inconsistent with EQ-2.58 taken in isolation, the project is considered overall to be consistent with the intent of the County policies for the Bayfront Conservation Zone. The possibility of returning undeveloped former marshes to more productive wildlife habitat by restoration is recognized as a potential purpose of the diked bay marshland and agricultural subzone in the MCP. Given the emphasis within County policies regarding enhancement of the wildlife and aquatic habitat of diked historic marshlands, the restoration of the site to habitats of higher quality and greater importance to the Novato Creek and San Pablo Bay ecosystems than those present today would be a higher priority use of the site than retaining the site in its current low-productivity agricultural setting.

City of Novato policies would apply to portions of the Bay Trail located on City or MCFCWCD land west of the HWRP and BMKV. The project in general is consistent with the overall intent of city policies related to shoreline uses. Discussion of the Bay Trail relative to land use is provided below under Impact LU-2. Discussion of the Bay Trail relative to biology is provided in the *Biological Resources* section of this chapter.

Overall the project is considered consistent with the intent of Marin County and City of Novato general plan policies for the bayfront lands and the potential inconsistencies noted above regarding fill and agriculture are considered less than significant impacts.

Discussion of flood zoning is presented above in the *Surface Water Hydrology and Tidal Hydraulics* section.

Impact LU-2: Compatibility with Designated Bay Trail Routes

As described previously in chapter 3, the proposed wetland restoration includes extending the Bay Trail south from the City levee along the HWRP perimeter levee, north from the City levee to Pacheco Pond, and then north to Bel Marin Keys Boulevard. Each alternative also includes construction of an interpretive center.

The unique portions of the Bay Trail routes and location of an interpretive center for each restoration alternative are described below.

Under Alternative 1, the Bay Trail would be located along the western edge of Pacheco Pond and connect to Bel Marin Keys Boulevard. The interpretive center would be located south of the HWRP seasonal wetland area. Under Spur Option 1A, a spur to the Bay Trail would extend from the west side of Pacheco Pond to Novato Creek along existing and new levees constructed for the wetland restoration.

Under Alternative 2, the Bay Trail would be located along the eastern edge of Pacheco Pond along the existing levee and connect to Bel Marin Keys Boulevard across the BMKV site. The interpretive center would be located on the BMKV site. Under Spur Option 2A, a spur to the Bay Trail would extend from the east side of Pacheco Pond to Novato Creek along a new levee constructed for the wetland restoration

Under Alternative 3, the Bay Trail would be located along the eastern edge of the expanded Pacheco Pond on the new levee and cross the BMKV site to Bel Marin Keys Boulevard. The interpretive center would be located on the BMKV site. Under Spur Option 3A, a spur to the Bay Trail would extend from the east side of Pacheco Pond to Novato Creek along a new levee constructed immediately south of the BMK south lagoon levee.

In general, the purpose of the Bay Trail Plan is to provide north–south access to facilitate and create recreational opportunities associated with the Bay. Alternatives 1–3, including both their common elements and their unique routes to Bel Marin Keys Boulevard, are generally consistent with this purpose. However, the Bay Trail proposed under Alternative 1 would not be consistent with the preferred connector route, according to the existing Bay Trail Plan

(along the eastern edge of Pacheco Pond) or the City of Novato Plan because it would require locating the Bay Trail along the western edge of Pacheco Pond. Since the dominant interest concerning the Bay Trail is establishing a north–south connection, the Alternative 1 routing is considered generally consistent with existing plans, and the impact is considered less than significant. Alternatives 2 and 3 are generally consistent with the current proposed Bay Trail route, although the last portion of the Bay Trail under these alternatives goes around the east side of Headquarters Hill whereas the designated route goes around the west side of Headquarters Hill. The design of the trail route under Alternatives 2 and 3 avoided the west side of the hill because of concerns about potential encroachment on private property.

Spur Options 1A, 2A, and 3A are not envisioned in current planning for the Bay Trail. However, construction of such spurs would not hinder the completion of a north–south connector from HAAF to Bel Marin Keys Boulevard. Although not called for in current Bay Trail planning, the spur options are not considered inconsistent with existing plans. The spur options would place a public trail in proximity to the BMK south lagoon, where no public trail currently exists. Under Alternatives 1 and 2, the trail would be located approximately 1,000 feet south of the BMK south lagoon levee. Given the distance from BMK south lagoon, the increase in noise due to foot traffic along the trail spur is not expected to result in a significant incompatibility with the BMK residential area. Visual aesthetics of new levee construction is discussed separately below in the *Aesthetics* section.

Under Alternative 3, the spur trail would be located on the new levee, approximately 50 feet south of the BMK south lagoon levee. In some areas, the trail would be approximately 150 to 200 feet from several houses in the eastern part of BMK residential areas, located at the southern end of streets facing south toward the south lagoon levee. This would result in additional noise from foot traffic in this area. However, use of the spur trail is expected to be infrequent and limited to foot traffic, so noise from trail use is not expected to result in significant disruption of adjacent residential uses. Visual aesthetics of construction of the new levee are discussed separately below in the *Aesthetics* section.

Impact LU-3: Conflict with Existing Utilities and Utility Easements

There are 5 electric transmission line towers and an NSD sewer line that are located on the expansion site. The construction of the proposed BMKV expansion has the potential to result in damage to the existing regional utilities infrastructure, through the disruption of service from the electric transmission lines and restricting access for maintenance activities. Prior to construction, concrete casings would be installed on the footings of the electric transmission line towers to prevent damage to the structures. Raised boardwalks would also provide maintenance access to the electric transmission line towers from the

proposed flood protection levee and the existing Novato Creek levee. Service would not be interrupted as a result of implementation of the proposed BMKV expansion, and therefore there would be no impact on the electric transmission line service.

Under Alternatives 1, 2, and 3, the new NSD sewer line would be installed adjacent to the current alignment, except around Pacheco Pond. Under Alternatives 1 and 3, a new section of pipeline would be installed around the eastern side of the expanded Pacheco Pond; under Alternative 2, the retrofitted or replacement pipeline would be installed in the levee between Pacheco Pond and the seasonal wetland restoration area. Access would continue to be provided by the berm that separates the expansion site from the HAAF site. Service would not be interrupted as a result of implementation of the proposed BMKV expansion under any of the alternatives, and therefore there would be no impact on existing utility service.

Under Alternatives 1 and 3, the proposed berm access trail between BMKV and HAAF on the NSD line would be constructed at an elevation of 4 to 6 feet. If the berm were constructed at 4 feet, the NSD line could not be accessed during all weather conditions, as tidal overflow would cover the berm. If the berm were constructed at 6 feet, all weather access would be possible, as tidal overflow at this elevation is rare. This impact is considered less than significant.

Impact LU-4: Conflict with Other Existing Easements

In addition to the PG&E and NSD easements, the BMKV site is also subject to the requirements of several drainage agreements with MCFCWCD and with BMK CSD, as well as a maintenance agreement with BMK CSD for the BMK south lagoon. The drainage agreements are discussed separately above in the *Surface Water Hydrology and Tidal Hydraulics* section.

The easement for the maintenance of the south lagoon levee allows BMK CSD access to the levee for maintenance. Under all alternatives, the BMK south lagoon would be improved, which would result in the levee being increased to a top height of approximately 6 feet NGVD. The current south lagoon levee ranges in height from 2 to 5 feet NGVD. In addition to improving the south lagoon levee, new water conveyance structures (Alternatives 1 and 2) or pumps (Alternative 3) would be installed to facilitate flow from the south lagoon to either a swale area or the tidal marsh restoration area. Access would be provided under any alternative for maintenance of the lagoon or water management structures.

The restoration alternatives are not expected to compromise the intent of the existing easements related to the maintenance of the south lagoon levee or overflow structure.

Impact LU-5: Conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to Non-Agricultural Use

No prime farmland, unique farmland, or farmland of statewide importance would be affected by habitat restoration on the BMKV site. The site currently supports farmland of local importance. The total amount of land converted (1,241 acres) would be small relative to the total area of land designated for agricultural use in Marin County (167,000 acres) (San Francisco International Airport 2001). Additionally, much of the site has remained fallow for many years, and therefore the site has not produced substantial crops to support the local agriculture economy. This impact is considered less than significant, and no mitigation is required.

Impacts and Mitigation Measures Unique to Alternatives 1 and 2

Impact LU-6: Modifications to Morphology of Novato Creek due to Breach of BMKV/Novato Creek Levee May Affect Navigation

The conceptual design plans for Alternatives 1 and 2 include a marsh basin connection to Novato Creek through a single levee breach. The breach would be located at the downstream end of the creek, only a few thousand feet from San Pablo Bay. Preliminary analysis of local scour from increased tidal prism reveals a minor widening of the channel, between 10 and 25 feet, and a minor deepening of the channel, approximately 0.5 feet, along the approximately 4,000-foot portion of Novato Creek, downstream of the breach to the mouth. The increase in tidal prism is also expected to cause additional widening and a minor deepening of the channel in the subtidal channel of Novato Creek, beyond the mouth.

These changes in morphology of the lower portion of Novato Creek are expected to occur directly adjacent to the existing main channel of Novato Creek, from the breach to the mouth, and the subtidal channel, beyond the mouth. Because the effect of adding tidal prism to this portion of the creek is a minor increase in channel width and depth, these changes in morphology are not expected to have a significant adverse effect on the navigability of Novato Creek. Since this portion of Novato Creek presently requires maintenance dredging to provide adequate channel size for boat passage, the addition of tidal prism is an incidental beneficial effect of the project on navigability, although the authorized purpose of this project is not navigation. It should be noted, however, that the potential addition by the project of 400 to 600 acres of tidal prism to this portion of Novato Creek is not expected to result in sufficient channel width or depth to eliminate the need for future maintenance dredging.

Impacts and Mitigation Measures Unique to Alternative 3

Impact LU-7: Inconsistency with the Long-Term Management Strategy Management Plan

The BMKV site is one of the 22 existing and potential locations identified by the LTMS Management Plan as possible reuse and upland placement areas for materials dredged from San Francisco Bay. Because Alternative 3 relies on natural sedimentation to establish suitable elevations for tidal marsh restoration, this alternative would not assist in the implementation of the LTMS Management Plan. The BMKV site contains approximately 13 million cubic yards of capacity for dredged material reuse in wetland creation and, along with the Montezuma and Skaggs Island sites, it is one of the largest potential reuse sites identified in the LTMS management plan. The infrastructure for dredged material off-loading is under construction at the HAAF site, adjacent to BMKV.

This impact is considered adverse because it may hinder the availability of suitable reuse sites, thus potentially slowing the LTMS goal of decreasing in-Bay disposal of dredged material over the next decade. No mitigation, short of changing to an alternative that uses dredged material, is available to mitigate this impact.

Whether this is an adverse impact depends on whether there are sufficient approved reuse and upland placement sites available to accommodate reasonably foreseeable maintenance dredging operations in San Francisco Bay, so as to implement the reduction in Bay disposal volumes as envisioned in the LTMS Management Plan. This determination is outside the scope of this study.

Hazardous Substances and Waste

Affected Environment

Data Sources

The information presented in this section is based on existing data and previous reports that apply to the proposed BMKV expansion site and the SLC site. Descriptions of hazardous materials investigations and cleanup refer to areas of concern within the BMKV and SLC parcels. Possible sources of introduced hazardous substances from fill materials are also described.

The primary sources of information used for this section include the following.

- *Hamilton Wetland Restoration Plan Final Environmental Impact Report/Environmental Impact Statement (EIR/EIS*) (Jones & Stokes 1998) and its sources
- *Bel Marin Keys Unit V Final EIR/EIS* (Environmental Science Associates 1993)
- *Phase I Environmental Assessment Bel Marin Keys Unit V* (Miller Pacific Engineering Group 1994)
- *Results of Shallow Soil Investigations, Bel Marin Keys Unit V Property* (Erler & Kalinowski, Inc. 2002)
- *Phase II Site Investigation Report North Antenna Field Hamilton Army Airfield* (IT Corporation 2000)
- *Draft Long-Term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region Policy EIS/Programmatic EIR* (U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, San Francisco Bay Conservation and Development Commission, San Francisco Bay Regional Water Quality Control Board, and California State Water Resources Control Board 1996)
- *Sediment Testing Data* (Advanced Biological Testing 1997, 2000)

In addition, the primary sources of information regarding the potential introduction of hazardous substances from dredged materials include the following.

- *Draft Bel Marin Keys Conceptual Restoration Design Technical Report* (Jones & Stokes 2002)
- *Oakland Harbor Navigation Improvement (50-Foot) Project Draft Feasibility Study and EIR/EIS* (U.S. Army Corps of Engineers and Port of Oakland 1998a, 1998b, 1998c, 1998d, and 1998e)

Regulatory Overview

Several federal and state agencies have regulations that govern the use, generation, transport, and disposal of hazardous substances. The principal federal regulatory agency is the federal EPA. The primary California state agency with similar authority and responsibility is the California EPA (Cal-EPA),which may delegate enforcement authority to other local agencies that have agreements with Cal-EPA. Federal regulations applicable to hazardous substances are contained primarily in Titles 29, 40, and 49 of the CFR. State regulations have been consolidated in Title 26 of the CCR.

The relevant regulations and governing agencies responsible for oversight and cleanup of hazardous substances at the proposed BMKV expansion site and the

adjacent SLC parcel, as well as determination of the suitability of dredged material for use in wetland restoration, are described below.

Bel Marin Keys Unit V Expansion Site

Hazardous materials and hazardous waste are regulated by the Resource Conservation and Recovery Act (RCRA); Comprehensive Environmental Response, Compensation and Liability Act (CERCLA); CCR Title 26 and other relevant state and federal regulations. Cal-EPA is the lead agency for regulatory enforcement and oversight of any potential cleanup activities.

State Lands Commission Parcel

Contamination related to former military and police uses is likely to be present on the SLC parcel, which is part of the authorized HWRP. Potentially contaminated sites include a rifle range, a pistol range, a night firing range, and a facility used for firefighter training. Electric transformers and underground and aboveground storage tanks are also present. In addition, several unexploded ordnance items have been found on the parcel (U.S. Army Corps of Engineers 1998).

The SLC parcel is currently being remediated under FUDS program. FUDS is an element of the Defense Environmental Restoration Program (DERP) (10 USC 2701 et seq.). It requires remediation of contaminated sites consistent with CERCLA, with the objective of finding a timely, cost-effective way to reduce the risk to human health, safety, and the environment resulting from past activities of the DoD.

All contaminants on the SLC parcel would be remediated to support reuse before ownership of the site is transferred (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998). It is expected that remedial cleanup values adopted for the HAAF would also be applicable to the SLC parcel because of the similarity of the 2 site histories, geologic conditions, and anticipated future land uses. The SLC parcel is currently in the preliminary assessment/site investigation portion of the CERCLA process. An interim removal action is planned at the conclusion of site investigations (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998).

Chemical Suitability of Dredged Material

In the San Francisco Bay region, a consortium of regulatory agencies has been established to address the long-term management of disposal of dredged materials from the Bay. The LTMS agencies—the Corps, EPA, Cal-EPA, San Francisco Bay RWQCB, BCDC, and SLC—have established a DMMO. The DMMO evaluates dredged material and makes recommendations on its chemical

and biological suitability for reuse in wetlands based on testing specific to the proposed site environment and criteria from federal and state laws and guidance documents.

Regional testing guidelines for dredged material are described in Corps Public Notice 99-3, "Proposed Guidelines for Implementing the Inland Testing Manual Within the USACE San Francisco District," and Public Notice 99-4, "Proposed Guidance for Sampling and Analysis Plans (Quality Assurance Project Plans) for Dredging Projects Within the USACE San Francisco District." The RWQCB has also developed criteria for evaluating the chemical suitability of dredged material for use in tidal and seasonal wetland restoration projects, upland habitat creation, and other upland uses. These criteria are found in the "Interim Sediment Screening Criteria and Testing Requirements for Wetland Creation and Upland Beneficial Reuse" (Wolfenden and Carlin 1992). The RWQCB is currently considering an update of these criteria (San Francisco Regional Water Quality Control Board 2000a). In addition, the RWQCB has prepared a TMDL report for mercury in San Francisco Bay, but the TMDL has not yet been formally adopted (San Francisco Regional Water Quality Control Board 2000b).

Source Areas of Hazardous Substances and Waste

The source areas where previous operations or activities may have generated hazardous substances and/or wastes within the BMKV site are described below. Contaminants identified or potentially present and the current remedial status of the SLC and HAAF sites (which are part of the authorized HWRP) are also described below.

Bel Marin Keys Unit V Expansion Site

A Phase I Environmental Site Assessment and a Phase II Shallow Soil Investigation were completed in 1994 and 2002, respectively, for the proposed BMKV expansion site. The Phase I assessment identified several items that warranted further attention. The Phase II investigation revealed source areas on the BMKV site that exhibited low-level contamination due to the presence of various hazardous substances and/or waste. The range of contamination for each type of hazardous substance identified in the Phase II investigation was generally below concentrations as established by the EPA Region IX Preliminary Remediation Goals (PRGs) for residential soil. The results of the Phase I and Phase II studies are summarized in table 4-8. Blymyer Engineers Inc. completed a previous environmental site assessment in 1989. The assessment performed shallow-soil sampling tests along the HAAF property boundary and on the BMKV parcel itself to test for petroleum hydrocarbons and herbicides/pesticides. The soil-sampling results showed that no detection of herbicide/pesticide compounds or petroleum hydrocarbons were present at the sampling locations (Miller Pacific Engineering Group 1994).

Table 4-8. Results of Phase I Environmental Site Assessment and Phase II Shallow Soil Investigation for the BMKV Expansion Site

Source	Potential Contaminant(s)	Results[1]
Concrete storage tank pads and dispenser (remnant piping) associated with a potential underground storage tank	Fuel	No observed indicators of prior spills or releases (Phase I) Metals detected in soil samples but at concentrations less than the EPA Region IX PRG for residential soil[2]; TPH as diesel detected in soil (Phase II)
Two 55–gallon metal drums	Unidentified liquid	Unidentified liquid visually observed (Phase I)
Several old, inoperative pieces of farm equipment	Vehicle related fluid ground stain	Visually observed fluid leakage (Phase I)
West barn area	Pesticides	DDT detected in soil samples but at concentrations less than the EPA Region IX PRG for residential soil; dioxins and furans detected in soil but at concentrations less than the ATSDR[3] screening level (Phase II)
East barn area	Pesticides	DDT detected in soil samples but at concentrations less than the EPA Region IX PRG for residential soil; dioxins and furans detected in soil but at concentrations less than the ATSDR screening level (Phase II)
Debris pile (150 ft x 30 ft)	Glass bottles, car tires, washing machines, water heaters, engine parts, cans etc.	No obvious hazardous materials were observed at the debris pile (Phase I) DDT and its breakdown products (DDD and DDE) detected, but at concentrations less than the EPA Region IX PRG for residential soil; lead (650 mg/kg) and arsenic (36 mg/kg) were the only metals detected in soil samples at concentrations greater than the EPA Region IX PRG for residential soil (Phase II)
Crop duster area	Pesticides, herbicides	None detected in soil samples (Phase II)
Drainage ditches/field	Organic compounds	Dioxins and furans detected in soil samples, but at concentrations less than the ATSDR screening level (Phase II)
East levee pump station intake piping that extends into the drainage ditch	Oils	Lubricant oil staining was visually observed on the piping (Phase I)
Possible septic tank/leach field	Septic/household	Presence unknown (Phase I)

Notes:

(1) Phase I refers to the Phase I site investigation conducted by Miller Pacific Engineering Group in 1994, Phase II refers to the Phase II soil investigation conducted by Erler and Kalinowski, Inc. in 2002. Sources that were investigated in each study may or may not overlap depending on the defined source areas of investigation in each report, which were developed independently.
(2) United States Environmental Protection Agency Region IX, Preliminary Remediation Goals, http://www.epa.gov/region09/waste/sfund/prg/
(3) Agency for Toxic Substances and Disease Registry Dioxin and Dioxin-Like Compounds in Soil, Part 1: ATSDR Interim Policy Guideline, Toxicology and Industrial Health, VoL. 13, No. 6, pp. 759-768, 1997

Sources: Miller Pacific Engineering Group 1994, Erler & Kalinowski, Inc. 2002.

Sediments dredged from the BMK lagoon and possibly Novato Creek were placed on a field in the northeast corner of the BMKV expansion site in the late 1980s. This soil was sampled in 2000 for mercury content. The results are presented in the table 4-9 below. The range of concentrations identified is below the EPA Region IX PRGs for residential soil for mercury (23 mg/kg) and methylmercury (6.1 mg/kg).

Table 4-9. Results of Dredged Material Area Soil Testing (2000) (mg/kg, dry weight)

	Mercury		Methylmercury	
Soil Horizon	Range	Avg.	Range	Avg.
0–6"	0.198–0.496	0.328	0.004–0.021	0.009
6–12"	0.096–0.389	0.268	0.001–0.0096	0.005
12–18"	0.176–0.361	0.270	0.001–0.0325	0.008

Source: Advanced Biological Testing, Inc, April 25, 2000.

State Lands Commission Parcel

A Phase II Site Investigation Report for the SLC site was completed in April 2000. The report identified the type and source of contaminants that could potentially be present at the site. The results of the investigation will be used to supplement the 1998 initial site investigation results (IT Corporation 2000) for risk evaluation, remedial action planning, and eventual property closure. Six areas were investigated in further detail based on the initial site investigation results. The results of the Phase II investigation for each of these key areas are summarized in table 4-10 below. A remedial investigation is planned to further characterize the nature and extent of chemicals of concern at the identified sites.

Hamilton Army Airfield Site

Past activities at the HAAF site have resulted in contamination or suspected contamination associated with soil contamination at the JP-4 jet fuel line, Buildings 20 and 26, and the dredged spoil area west of Building 20. The Corps is currently in the process of investigating and remediating this site in accordance with all applicable state and federal laws governing hazardous waste remediation (Miller Pacific Engineering Group 1994).

Table 4-10. Results of Phase II Site Investigation for SLC Parcel

Source Area	Potential Contaminant(s)	Results
Rifle range and skeet range	Lead (Pb), soluble lead, and pH	12 out of 22 samples had total Pb concentrations greater than BRAC ambient Pb concentrations.
Fire practice burn pit and surrounding disturbed area	Metals, pesticides and PCBs, PNAs, extractable TPH, VOCs, and dioxins/furans	A number of metals were detected at concentrations greater than BRAC ambient concentrations. Polynuclear aromatic hydrocarbons (PNAs), pesticides, PCB-1260, tetrachloroethane, and a number of dioxin/furan compounds were also detected in samples collected at the site.
Abandoned automobile and levee berm area	CAM-17 metals, PNAs, pesticides, PCBs, and extractable and purgeable TPH	A number of metals were detected at concentrations that exceeded the BRAC ambient concentrations. PNAs and pesticides were also detected.
Support facilities and disturbed area	CAM-17 metals, PNAs, pesticides, PCBs, and extractable and purgeable TPH	Antimony was found at a concentration exceeding BRAC ambient concentrations. PNAs, pesticides, and hydrocarbons were also detected.
Northwest disturbed area	CAM17 metals, PNAs, pesticides, PCBs, and extractable TCH	Molybdenum and silver were identified above BRAC ambient concentrations. PNAs and pesticides were also detected.
Western property boundary disturbed area	CAM-17 metals, PNAs, pesticides, PCBs, and extractable and purgeable TPH	ACu, Mb, and Ag were identified above BRAC ambient concentrations. PNA compounds were also detected.

Source: IT Corporation 2000.

Sediment Quality

Dredged Material

An estimated 5,000–40,000 tons of contaminants, comprising at least 65 types of materials, are deposited in San Francisco Bay annually. These contaminants include trace elements such as copper, nickel, silver, zinc, and synthetic organic compounds (e.g., organochlorine pesticides, polychlorinated biphenyls [PCBs], and polynuclear aromatic hydrocarbons [PNAs]). The contaminants originate with numerous industrial, agricultural, natural, and domestic activities and reach

the estuary through various means, such as river flow, storm drains, discharges from maritime vessels, and disposal of dredged materials. Many persistent contaminants become bound to particulate matter and accumulate in areas of sediment deposition. Once these contaminants enter the Bay and estuary, their fate is determined by a combination of physical, chemical, and biological processes (U.S. Army Corps of Engineers 1994b).

The processes of dredging and placement of dredged materials in San Francisco Bay or in environments such as the proposed expansion site may disturb and redistribute contaminants that have been buried or otherwise sequestered in the sediments. These contaminants, once disturbed, may become biologically available in sediments and water at the site and exert toxic effects upon organisms that come in contact with them. The behavior of contaminants associated with sediments is difficult to predict but is influenced by temperature, amount of oxygen available, degree of acidity, sediment organic-carbon content, salinity, and biological activity. The specific characteristics of each environment in which sediments are deposited will determine the mobility and toxicity of the contaminants and, in turn, the way in which those contaminants can affect organisms.

Dredged material may originate from many sources, including the Port of Oakland 50-foot Deepening Project, Corps operations and maintenance dredging program; and other non-federal dredging projects.

Each dredging project requires a dredging permit, and the quality of sediments is reviewed as part of each permit application by the RWQCB, EPA, and, for nonfederal projects, the Corps. Sufficient data are available to identify, in general terms, the chemical constituents that may be present in dredged sediments from the various potential source locations around the Bay (U.S. Army Corps of Engineers 1994b.).

As stated previously, the suitability of dredged material for the expansion site would be determined through the existing testing and suitability framework used by the state and federal agencies charged with approving placement of material dredged from San Francisco Bay through the DMMO. The agencies require dredging project applicants to sample and test sediments proposed to be dredged for chemical constituents of concern and for toxicity, using protocols acceptable to the agencies. The adequacy of the sampling and testing is evaluated by the DMMO, which then reviews the test results to evaluate the acceptability of the dredged material for placement at proposed sites in the Bay, ocean, wetland, or upland environments.

To aid in determining the suitability of dredged material for use in wetland environments, the RWQCB has developed guidelines, known as the Wolfenden and Carlin Guidelines (Wolfenden and Carlin 1992), that identify screening criteria for contaminant levels for use in wetland projects. The RWQCB is currently considering an update of these screening criteria to include the results of recent ambient sediment sampling and other sediment studies (Regional Water

Quality Control Board 2000a). The DMMO would use these guidelines to assess any dredged material proposed for use at the expansion site.

Two types of material may be placed at upland/bayland sites and used for wetland creation or restoration, based generally on the concentration of particular contaminants and the results of bioassays. These materials are described below.

- Cover sediments are those that would pass leaching and bioassay tests and contain certain contaminants at concentrations less than those specified in the RWQCB's interim screening criteria. The interim screening criteria are shown in table 4-11 compared to ambient-level thresholds of the same contaminants in the Bay. New draft screening criteria for cover material proposed in 2000 are, for the most part, based on ambient thresholds. Cover material can be used in wetland creation and restoration areas, for levee construction, and for covering noncover materials. DMMO may also take into account local ambient sediment quality when considering site-specific determinations for locally appropriate cover criteria.
- Noncover sediments are those that pass leaching tests and have contaminant concentrations that exceed criteria for cover sediments, but do not exceed the criteria for noncover sediments. Noncover material must be covered on the top and sides by a minimum of 3 feet of cover material or material native to the site.

Table 4-11. San Francisco Bay Sediment Screening Criteria and Ambient-Level Thresholds (mg/kg)

	RWQCB 1992 Sediment Screening Criteria[1]		RWQCB Draft 2000 Sediment Screening Criteria[2]		Ambient-Level Thresholds[3]
Analyte	Cover	Noncover	Cover	Noncover	<100% fines
Arsenic	33	85	15.3	70	15.3
Cadmium	5	9	0.33	9.6	0.33
Chromium	220	300	112	370	112
Copper	90	390	68.1	270	68.1
Lead	90	110	43.2	218	43.2
Mercury	0.35	1.3	0.43	0.7	0.43
Nickel	140	200	112	120	112
Selenium	0.7	1.4	0.64		0.64
Silver	1.0	2.2	0.58	3.7	0.58
Zinc	160	270	158	410	158
PCBs (Total)	0.05	0.4	22.7	180	.0148
Pesticides (Total DDT)	0.003	0.1	0.007	0.0461	.007
PAHs (polyaromatic hydrocarbons) (Total)	4	35	3.39	44.792	3.39

1 = Wolfenden, John D. and Michael P. Carlin, Interim Sediment Screening Criteria and Testing Requirements for Wetland Creation and Upland Beneficial Reuse, prepared for California Regional Water Quality Control Board, San Francisco Bay Region, December 1992.

2 = San Francisco Regional Water Quality Control Board (SF RWQCB), Draft Staff Report, Beneficial Reuse of Dredged Materials: Sediment Screening and Testing Guidelines, May, 2000.

3 = SFRWQCB 1998, Ambient Concentrations of Toxic Chemicals in San Francisco Bay Sediments, May 1998. Note that these thresholds are based on the 85th percentile for 100% fines based on statistical evaluation of ambient concentrations found in reference sediment samples.

Although the current and draft screening criteria specify slightly differing guidelines for cover material (which can be used anywhere in a wetland) and noncover material (which needs to be properly buried), only material appropriate for cover, as determined by the DMMO, would be accepted for use at the expansion site. Separate tests for contaminant leaching are used to evaluate the

acceptability of material for upland disposal. Only material found suitable by the DMMO would be used as part of the upland components of the proposed BMKV expansion.

Mercury Concentrations in Novato Creek and San Pablo Bay Sediments

Because the restoration alternatives include breaches to San Pablo Bay and Novato Creek and would either rely on natural sedimentation for wetland formation or receive natural sedimentation after deposition of dredged material, sediments from the adjacent portions of San Pablo Bay and Novato Creek would be deposited within parts of the wetland restoration site. As described above, in general for San Francisco Bay sediments, a variety of natural and anthropogenic sources of chemical constituents have influenced the sediment chemistry of Novato Creek. Mercury has been identified as a constituent of concern in San Pablo Bay and in Novato Creek.

Sediment sampling was conducted by the BMK CSD in 1996, including samples collected from Novato Creek just north of the BMKV site. With the exception of mercury, all of the metals detected in the samples were at concentrations below the 1992 interim sediment screening criteria. Mercury was detected in a composite of the 2 Novato Creek sediment samples at concentration (0.74 mg/kg, dry weight) above the cover and noncover screening criteria (Advanced Biological Testing 1997).

Additional sediment sampling was conducted by the BMK Homeowners Association concerning mercury in sediments in Novato Creek (Advanced Biological Testing 2000). The results are summarized in table 4-12 below.

Table 4-12. Results of Novato Creek Sampling (2000)

	Mercury (mg/kg, dry weight)		Methylmercury (mg/kg)	
	Range	Average	Range	Average
Sediments (0–6")	0.273–0.479	0.384	0.001–0.0228	0.011
Sediments (6–12")	0.348–0.511	0.424	0.0011–0.0261	0.008
Sediments (12–18")	0.338–0.506	0.397	0.0017–0.0434	0.014

Samples collected from north of BMKV near mouth of creek and from upstream/downstream of Hwy 37.

Source: Advanced Biological Testing, Inc, April 25, 2000

The San Francisco RWQCB has analyzed ambient conditions throughout San Francisco Bay, including San Pablo Bay. The results are summarized in table 4-13 below.

Table 4-13. San Pablo Bay/Carquinez Strait Reference Site Sampling

	Mercury (mg/kg)		
	Paradise Cove	Tubbs Island	Island # 1
San Pablo Bay/Carquinez Reference Sites	0.304	0.35	0.274

Source: Regional Water Quality Control Board 1998

Based on these results, the sampled sediments in Novato Creek and San Pablo Bay would all meet the noncover current and proposed screening criteria. Some of the sediments in Novato Creek and all of the reference-site sediment concentrations in San Pablo Bay are under the current and proposed screening criteria for cover material. Some of the Novato Creek sediment concentrations detected in the sampling are above the current and proposed sediment screening criteria for cover material. Site-specific studies of sediment contaminants could be undertaken to support regulatory decisions and supplement existing data. In addition, DMMO may take into account local (e.g. Novato Creek) ambient conditions rather than San Pablo Bay-wide ambient conditions when making determinations of appropriate criteria for wetland criteria.

Environmental Consequences and Mitigation Measures

Approach and Methods

The approach and methods used to evaluate hazardous substances and waste consisted of reviewing available reports regarding potential contaminants present at the site. In addition, data were reviewed regarding contaminant concentrations in potential dredged material proposed for reuse at the site. Potential impacts on public health from the release of onsite or imported contaminants were reviewed, including an assessment of toxicity and potential exposure pathways.

Thresholds of Significance

The following significance criteria were used to evaluate the proposed BMKV expansion. Regarding hazardous substances and waste, the proposed expansion was identified as resulting in a significant impact on the environment if it would

- create a potential public health hazard; or
- involve the release of onsite contaminants or imported contaminants that pose a hazard to human, animal, or plant populations in the area affected.

Impacts and Mitigation Measures of No-Action Alternative

No new impacts related to hazardous waste would occur under the No-Action Alternative. Regardless of final disposition of the proposed wetland site, identification, remediation, and/or disposal of hazardous waste would be performed as necessary by the Conservancy in accordance with appropriate local, state, and federal regulations. The required level of remediation, however, may vary based on the selected final use of the expansion area.

No impacts associated with sediment quality would occur because no dredged material would be imported onto the BMKV or SLC parcels.

Impacts and Mitigation Measures Common to Alternatives 1–3

Impact HAZ-1: Potential Exposure of Humans, Plants, or Wildlife to Contaminants as a Result of Remediation Activities for the Proposed Action

The lead agencies are required to perform appropriate cleanup of all hazardous waste sites located on the BMKV site, as well as on the SLC and HAAF sites (which are part of the authorized HWRP) in accordance with RCRA, CERCLA, CCR Title 26, and other applicable local, state, and federal regulations.

According to the Phase I and Phase II assessments of the BMKV expansion site, evidence of significant hazardous substances was not found on the BMKV parcel. Shallow-soil sampling conducted in the Phase II site assessment revealed the presence of metals, diesel fuel residue, DDT, dioxins, and furans within soils in several areas on the BMKV parcel. Detections of DDT and most metals in soils were at concentrations less than their corresponding EPA Region IX PRGs for residential soil, with the exception of lead and arsenic in a sample from beneath a debris pile. Dioxins and furans were detected in several soil samples but at concentrations less than the Agency for Toxic Substances and Disease Registry (ATSDR) screening levels for evaluation (Agency for Toxic Substances and Disease Registry 1997). Although the areas affected by potential soil contamination are limited, if left in place, there is the possibility of exposure of any associated contamination in the restoration area. To reduce this impact to a less-than-significant-level Mitigation Measure HAZ-1 would be implemented. The SLC parcel, which is part of the authorized HWRP, is regulated under the FUDS program. The lead agencies are required to investigate and remediate identified toxic or hazardous substances to reduce the risk of exposure to humans and prevent ecological degradation. Because of the cleanup requirements discussed above, the potential to expose humans, plants, and wildlife to contaminants is considered less than significant.

Mitigation Measure HAZ-1: Coordinate with Department of Toxic Substances Control on Site Clean-Up Requirements Prior to Construction.

The Conservancy shall coordinate with the Department of Toxic Substances Control (DTSC) on defining DTSC's requirements for site clean-up based on the results of the Phase I and II site investigations. The requirements could include clean-up measures described in the Phase I study, as appropriate, potentially including limited removal and additional testing, as determined in consultation with DTSC, to address the identified concerns on the BMKV site. These measures should be evaluated in light of the proposed reuse and implemented prior to construction, as appropriate and in coordination with the DTSC. Any remedial activities will be in compliance with applicable local, state, and federal regulations.

Impact HAZ-2: Potential Exposure of Humans, Plants, or Wildlife to Hazardous Chemicals Contained in Dredged Material Used as Fill Material

The process of dredging material from various sources and placing this material to expedite creation of wetlands could disturb and redistribute contaminants that have been buried or otherwise sequestered in the sediments. Once disturbed, these contaminants may become biologically available in sediments and water while being deposited at the site and may exert toxic effects on organisms that come in contact with them. Sediment screening would be conducted in accordance with the current requirements established by the DMMO, Corps, RWQCB, and other LTMS agencies.

Because the proposed BMKV expansion would make use of only cover-quality dredged material that satisfies the cover criteria, this impact is considered less than significant in regards to sediment quality, and no mitigation is required (see below concerning water quality).

As described in the *Water Quality* section in this chapter, although mercury often resides in forms that are not hazardous, it can be transformed through natural processes into toxic methylmercury. Although it is likely that mercury methylation would increase as a result of the dredged placement approach, it is not clear whether the act of placement causes more notable effects than the act of dredging or whether either of those effects are more notable than the natural methylation processes. Because no definitive conclusion can be made about this impact, it is considered significant. To reduce this impact to a less-than-significant level, mitigation measure WQ-1, as proposed in the *Water Quality* section, would be implemented.

Impact HAZ-3: Potential Exposure of Humans, Plants, or Wildlife to Hazardous Chemicals due to Sedimentation from Novato Creek and/or San Pablo Bay

Final wetland cover in the three restoration alternatives would come from sediment carried to the site by Novato Creek, nearby Petaluma River, and San Pablo Bay, As described above, in prior limited sampling efforts, some of the sediments in Novato Creek have concentrations of mercury that are greater than the existing and proposed cover-sediment screening criteria. However, the sample results reviewed for creek sediments near the site did not indicate concentrations of mercury greater than the existing or proposed noncover criteria. Sampling to date has been limited, and conclusions about the quality of Novato Creek sediments could change if site-specific studies were conducted. It is also possible that some sediments near the site in San Pablo Bay may have concentrations of mercury greater than the sediment screening criteria for cover material.

Although only cover-quality dredged material would be used for wetland-creation fill, natural sedimentation after breaching would result in migration of sediment into the restoration area, with potential concentrations of mercury in some sediments being greater than the cover-sediment screening criteria. While sediments from Novato Creek and San Pablo Bay would nominally have ambient concentrations of mercury, this would not eliminate the potential for mercury methylation in the restored wetland area.

The primary concern about the deposition of sediments that contain elevated concentrations of mercury in the wetland restoration area is that it may increase the rate of mercury methylation, which could affect water quality. Due to the biomagnification potential of methylmercury, increased methylation could affect wildlife that may utilize the restoration site or nearby environments. However, it is not currently possible to estimate the methylmercury concentrations or bioaccumulation and biomagnification in the food chain that may occur. As discussed in the *Water Quality* section, because a clear conclusion cannot be made regarding the potential for a significant adverse effect on the environment, this impact is considered significant and unavoidable. Mitigation WQ-1, a methylmercury adaptive management plan, is proposed to be developed in concert with the appropriate regulatory agencies, including those responsible for protection of biological resources such as DFG, USFWS, and NMFS. See the *Water Quality* section for further discussion.

Transportation

This section analyzes the potential effects of the proposed BMKV expansion on traffic and transportation.

Affected Environment

Data Sources

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

- *Hamilton Wetland Restoration Plan Final EIR/EIS* (Jones & Stokes 1998)
- *Environmental Analysis of Tidal Marsh Restoration in San Francisco Bay* (Jones & Stokes 2001)

Roadway Network

Regional Access

Regional access to the expansion site is provided by U.S. Highway 101 and State Route 37. U.S. Highway 101 is a principal north–south freeway that connects the expansion site to Sonoma County to the north and the San Francisco Bay Area to the south. State Route 37 extends east from U.S. Highway 101 in Novato to Interstate 80 in Vallejo.

Access to BMKV Expansion Area

Access to the BMKV site is provided by Ignacio Boulevard and Bel Marin Keys Boulevard. Ignacio Boulevard provides access to the site from U.S. Highway 101, turning into Bel Marin Keys Boulevard as the site is approached from the west. No public roadways exist within the BMKV parcel. The existing private roads on the site are used primarily for agricultural operations.

The SLC site may be accessed by a legally deeded access easement across the HAAF site. Although no official map of the easement exists, it is described as a 40-foot easement that extends from the entrance of the HAAF site to the SLC property. The easement is located adjacent to the Bay, and crosses over existing roads, including Main Gate Road, Palm Drive, Hangar Avenue, and Perimeter Road.

Existing Levels of Service

Traffic and transportation movement is measured by a level of service (LOS) rating, which ranges from A to F. LOS A is operationally the most efficient and generally exhibits the least amount of traffic delays and resulting congestion. Each successive LOS (B through F) is less operationally efficient. Standard descriptions of LOS service are provided in tables 4-14 and 4-15. The existing LOS for the 2 critical intersections that provide access to the expansion area from

Table 4-14. Signalized Intersection LOS Criteria

LOS	Sum of Critical Volume to Capacity Ratio	Description
A	< 0.60	Operations with very low control delay, up to 10 seconds per vehicle. This LOS occurs when progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.
B	0.61 – 0.70	Operations with control delay great than 10 and up to 20 seconds per vehicle. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of average delay.
C	0.71 – 0.80	Operations with control delay greater than 20 and up to 35 seconds per vehicle. These higher delays may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level, though many still pass through the intersection without stopping.
D	0.81 – 0.90	Operations with control delay greater than 35 seconds and up to 55 seconds per vehicle. At level D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable .
E	0.91 – 1.00	Operations with control delay greater than 55 and up to 80 seconds per vehicle. This level is considered by many agencies to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. The individual cycle failures are frequent occurrences.
F	> 1.00	Operation with control delay in excess of 80 seconds per vehicle. This level, considered to be unacceptable with oversaturation, that is, when arrival flow rates exceed the capacity of the intersection. It may also occur at high v/c ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be contributing factors to such delay levels.

Source: Contra Costa Transportation Authority, Technical Procedures, 1997.

Highway 101 are estimated to range from B to D during a.m. and p.m. peak hours (see table 4-16). The LOS for existing peak-hour freeway operations is estimated to range from D to E/F on U.S. Highway 101 and is estimated at B on State Route 37, within the vicinity of the expansion area.

Table 4-15. Unsignalized Intersection LOS Criteria

Level of Service	**Description**	**Average Control per Vehicle (Seconds)**
A	Little or no delays.	≤ 10.0
B	Short traffic delays.	> 10.0 to 15.0
C	Average traffic delays.	> 15.0 to 25.0
D	Long traffic delays.	> 25.0 to 35.0
E	Very long traffic delays	> 35.0 to 50.0
F	Extreme traffic delays with intersection capacity exceeded.	> 50.0

Source: Transportation Research Board Highway Capacity Manual, 2000.

Table 4-16. Intersection Level of Service and Peak-Hour Freeway Operations

	LOS	
Intersection	A.M.	P.M.
Ignacio Boulevard/U.S. Highway 101 southbound ramps	D	C
Ignacio Boulevard/U.S. Highway 101 northbound ramps	B	D

Source: Hamilton Wetland Restoration Plan EIR/EIS, 1998.

Environmental Consequences and Mitigation Measures

This section analyzes impacts on transportation associated with construction and operation of each restoration alternative. Impacts associated with transporting materials from the dredge site to the hydraulic off-loaders have been evaluated as part of other environmental documentation for the Oakland Harbor navigation improvement project (U.S. Army Corps of Engineers and Port of Oakland 1998a, 1998b, 1998c, and 1998d). The document concluded that transporting dredged material by barge would not result in a significant impact on transportation.

Approach and Methods

Implementation of the proposed BMKV expansion could result in impacts associated with construction, operation, and maintenance of the expansion site. Construction-related impacts could result from trips made by construction workers to and from the expansion site. Operation and maintenance impacts may occur as a result of trips made to the site by caretakers, researchers, or visitors.

Assigning LOS is a quantitative method for describing traffic conditions on intersections and road segments. LOS ranges from A (uncongested) to F (totally congested). Under the No-Action Alternative, it is assumed that existing land uses would remain the same, and therefore there would be no increase in existing traffic conditions at major intersections providing access to the site, as shown in table 4-16.

The total number of daily trips generated during the construction phase of the proposed BMKV expansion was based on the equipment estimates for the construction phase of the proposed BMKV expansion. The largest number of construction vehicles would be used during the enhancement and construction of perimeter and internal levees. Based on the number of pieces of construction equipment needed, construction of the proposed BMKV expansion was estimated to result in an increase of up to approximately 72 daily vehicle trips to the expansion site, including 17 trips during each the morning and evening commute period, and 10 during the lunch hour. The methods and assumptions used to arrive at this estimate are described in appendix E.

Visitation by the public would be allowed after construction is completed. Public use would be restricted to the interpretive center and the Bay Trail routes that are proposed around the perimeter and within the expansion site. Trips associated with public use and operation and maintenance of the proposed BMKV expansion are expected to be minimal and are not expected to affect circulation patterns or capacity at nearby intersections or roadway alignments. Parking would be provided at the interpretive center/trailhead.

Impact Mechanisms

Construction of the proposed BMKV expansion is the impact mechanism that would affect transportation, particularly construction related to perimeter and internal levee enhancement and creation.

Thresholds of Significance

The following significance criteria were used to evaluate the proposed BMKV expansion. Regarding transportation, the proposed expansion was identified as resulting in a significant impact on the environment if it would

- cause the LOS at local intersections to increase to unacceptable levels (typically, from LOS D or better to LOS E or F);
- substantially increase traffic volumes such that traffic increases along freeways or ramps that previously had an acceptable LOS;
- contribute substantially to traffic congestion at local intersections, ramps, or freeways that already operate at an unacceptable LOS; or
- interfere with existing transportation systems, causing substantial alteration by exceeding existing or proposed transit capacity, or cause transit delays, by resulting in an unacceptable LOS.

Impacts and Mitigation Measures of the No-Action Alternative

Under the No-Action alternative, no restoration activities would occur, and no impact on LOS at major intersections and roadway segments adjacent to the expansion area would occur.

Impacts and Mitigation Measures Common to Alternatives 1–3

Impact T-1: Change in LOS at Important Intersections and Roadway Segments during the Construction Phase

Restoration activities would increase the number of vehicle trips to the expansion site by an estimated 17 daily construction-worker vehicles per day under Alternatives 1–3 during the site preparation phase. Including construction vehicle activity from the site, this could result in up to approximately 72 vehicle trips to and from the site on a daily basis for several years. Dredged material would then be placed on the expansion site under Phase 2 of site construction, "Dredged Material Placement." Phase 2 would last approximately 10 years under Alternatives 1 and 2, and 3 years under Alternative 3. During Phase 2, the number of construction vehicles travelling to and from the site would largely decrease because construction activities would focus on off-loading dredged material to the site. Therefore, the placement of dredged material requires far less construction equipment travelling to and from the site on a daily basis. Following the placement of dredged material on the site, Phase 3, "Earthwork and Tidal Connection," would last approximately 1 year for each alternative and would increase the number of construction vehicles travelling to and from the site from Phase 2. The number of vehicles expected during Phase 3 would not exceed the number of estimated vehicles under Phase 1 of site construction.

Based on the existing LOS for intersections and roadway segments shown in table 4-16, the expected daily increase in construction traffic would not change

the LOS on freeway alignments or important intersections that support the expansion site. Because the minimal increase in daily traffic is not expected to result in a change in LOS, the impact on transportation under Alternatives 1–3 is considered less than significant. No mitigation is required.

Impact T-2: Change in LOS at Important Intersections and Roadway Segments during the Operation Phase

During the operation phase of the proposed BMKV expansion under Alternatives 1–3, a minimal number of trips to the expansion site would be required for maintenance and monitoring activities and for access to the Bay Trail and interpretive center. The number of daily trips expected under the operation phase of the proposed BMKV expansion would be greatly reduced from the construction phase of the proposed BMKV expansion. The number of additional trips attributable to maintenance and monitoring and recreational users would be small compared to the existing volume of traffic at intersections and roadway segments that support the expansion site. A small amount of parking (10 to 20 spaces) would be provided at the interpretive center location. Impacts on traffic circulation attributable to operation of the proposed BMKV expansion are considered less than significant because the LOS at roadway segments and intersections is not expected to change. No mitigation is required.

Air Quality

Affected Environment

Data Sources

The existing air quality conditions for the proposed expansion area were defined using information provided in the *Hamilton Wetland Restoration Plan Final EIR/EIS* (Jones & Stokes 1998). In addition, the Bay Area Air Quality Management District's (BAAQMD's) guidelines for assessing air quality impacts were used to evaluate the environmental effects associated with the proposed restoration alternatives (Bay Area Air Quality Management District 1999).

Climate

The concentration of a given pollutant in the atmosphere is determined by the amount of pollutant released and the atmosphere's ability to transport and dilute the pollutant. The major determinants of air pollution transport and dilution are wind, atmospheric stability, terrain, and insolation.

The topography of Novato is generally flat, and elevation is less than 100 feet above sea level. The expansion area is characterized by warm, dry summers and cool, moist winters.

Figure 4-11 shows the wind rose for a meteorological station located at HAAF, which is adjacent to the expansion area. The wind rose shows the percentage of time wind blows in each direction and the mean wind speed by direction. Annually, the predominant wind direction is from the northwest. During spring and fall, the predominant direction is from the west-northwest. The predominant wind direction is from the east-southeast during summer and from the north-northwest during winter. Mean wind speeds range from 5 to 10 miles per hour, and calm winds occur 31.3% of the time (California Air Resources Board 1984).

Federal and State Ambient Air Quality Standards

The State of California and the federal government have each established ambient air quality standards for air pollutants (see table 4-17). For some pollutants, separate standards have been set for different periods, with most standards set to protect public health; however, for some pollutants, standards have been based on other values, such as protection of crops, protection of materials, or avoidance of nuisance conditions.

The air pollutants of greatest concern in the expansion area include carbon monoxide (CO), ozone, and inhalable particulate matter less than 10 microns in diameter (PM10).

State and Federal Attainment Status

The San Francisco Bay Area Air Basin (SFBAAB) includes the City of San Francisco; portions of Sonoma and Solano Counties; and all of San Mateo, Santa Clara, Alameda, Contra Costa, Marin, and Napa Counties.

The SFBAAB is currently classified as a nonattainment area for the state PM10 standards and for the state and federal ozone standards. The SFBAAB is an attainment area for the federal PM10 standards and for the state and federal NO2 and SO2 standards. The SFBAAB is also an attainment area for the state CO standards and a maintenance area for the federal CO standards.

State and Federal Air Quality Management Programs

Air pollution control programs were established in California before the enactment of federal requirements. Federal Clean Air Act legislation in the 1970s resulted in a gradual merging of state and federal air quality programs, particularly those relating to industrial sources. Air quality management

Table 4-17. Federal and State Ambient Air Quality Standards

Pollutant	Averaging Time	State Standard	Federal Standard
Ozone	8 hours	—	0.08 ppm
	1 hour	0.09 ppm (180 μg/m^3)	0.12 ppm (235μg/m^3)
Carbon Monoxide	8 hours	9.0 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)
	1 hour	20 ppm (23 mg/m^3)	35 ppm(40 mg/m^3)
Nitrogen Dioxide	annual average	—	0.053 ppm (100 μg/m^3)
	1 hour	0.25 ppm (470 μg/m^3)	—
Sulfur Dioxide	annual average	—	80 μg/m^3 (0.03 ppm)
	24 hours	0.04 ppm (105 μg/m^3)	365 μg/m^3 (0.14 ppm)
	1 hour	0.25 ppm (655 μg/m^3)	—
Particulate Matter (PM10)	annual arithmetic mean	—	50 μg/m^3
	annual geometric mean	30 μg/m^3	—
	24 hours	50 μg/m^3	150 μg/m^3
Particulate Matter—Fine (PM2.5)	annual arithmetic mean	—	15 μg/m^3
	24 hours	—	65 μg/m^3
Sulfates	24 hours	25 μg/m^3	—
Lead	calendar quarter	—	1.5 μg/m^3
	30-day average	1.5 μg/m^3	—
Hydrogen Sulfide	1 hour	0.03 ppm (42 μg/m^3)	—
Vinyl Chloride (chloroethene)	24 hours	0.010 ppm (26 μg/m^3)	—
Visibility-Reducing Particles	8 hours (1000–1800 PST)	*	—

Notes: ppm = parts per million
mg/m^3 = milligrams per cubic meter
μg/m^3 = micrograms per cubic meter

* Statewide VRP Standard (except Lake Tahoe Air Basin): Particles in sufficient amount to produce an extinction coefficient of 0.23 per kilometer when the relative humidity is less than 70%. This standard is intended to limit the frequency and severity of visibility impairment due to regional haze and is equivalent to a 10-mile nominal visual range.

programs developed in California since the late 1980s have generally responded to requirements established by the federal Clean Air Act.

The enactment of the California Clean Air Act in 1988 and the federal Clean Air Act Amendments of 1990 has produced additional changes in the structure and administration of air quality management programs. The California Clean Air Act requires preparation of an air quality attainment plan for any area that violates state air quality standards for CO, sulfur dioxide (SO2), nitrogen dioxide (NO2), or ozone. Locally prepared attainment plans are not required for areas that violate the state standards for PM10. The California Air Resources Board (CARB) is addressing PM10 attainment issues.

Air pollution problems in the SFBAAB are primarily the result of locally generated emissions. The SFBAAB, however, has been identified as a source of ozone precursor emissions, which occasionally contribute to air quality problems in the Monterey Bay area, the northern San Joaquin Valley, and the southern Sacramento Valley. Consequently, in addition to correcting local air pollution problems, air quality planning efforts for the SFBAAB must also reduce the area's impact on downwind air basins.

The BAAQMD has prepared 2 recent air quality plans designed to bring the SFBAAB into attainment with ozone standards. The 1999 Ozone Attainment Plan was designed to bring the SFBAAB into attainment with the federal ozone ambient air quality standards. It was approved by the CARB but was partially disapproved by the U.S. EPA (Bay Area Air Quality Management District, Metropolitan Transportation Commission, and Association of Bay Area Governments 1999; www.BAAQMD.gov). This plan contained 11 control strategy measures that would have included development and implementation of additional air quality rules and regulations for emission sources within the SFBAAB. A Bay Area 2001 Ozone Attainment Plan is currently being prepared by the BAAQMD, the Metropolitan Transportation Commission, and the Association of Bay Area Governments. This plan is a proposed revision to the Bay Area portion of California's plan to achieve the national ozone standard. The plan is being prepared in response to EPA's partial approval and partial disapproval of the Bay Area's 1999 Ozone Attainment Plan.

On December 20, 2000, the BAAQMD adopted the 2000 Clean Air Plan (CAP) (Bay Area Air Quality Management District 2000). The CAP represents the third triennial update of the 1991 CAP. It contains additional rules and regulations that are designed to bring the SFBAAB into attainment with the California ozone ambient air quality standards.

Federal Clean Air Act Conformity

As required by the 1990 Federal Clean Air Act Amendments, EPA enacted 2 separate federal conformity rules. Those rules (incorporated as Section 40 CFR Parts 51 and 93) are designed to ensure that federal actions do not cause or

contribute to air quality violations in areas that do not meet the national ambient air quality standards. The 2 rules include transportation conformity, which applies to transportation plans, programs, and projects, and general conformity, which applies to all other nontransportation-related projects.

The general, conformity regulation requires that federal agencies sponsoring nontransportation-related activities show that the emissions associated with those activities conform to state implementation plans (SIPs) if emissions meet specific criteria. First, the emissions must occur in areas designated as nonattainment areas for one or more of the federal ambient air quality standards. Second, those emissions must exceed certain de minimis threshold levels.

The proposed wetland restoration is subject to a federal conformity analysis under the general conformity rule. Currently, the SFBAAB, which includes Marin County, where the proposed wetland restoration is located, is classified as a moderate federal nonattainment area for ozone. Ozone is an indirectly generated pollutant that results when the ozone precursors NOx and reactive organic gases (ROG) form in the atmosphere in the presence of sunlight. Because ozone is not a directly emitted pollutant, EPA has, in its general conformity regulations, set de minimis levels for ozone precursors rather than for ozone. From a conformity standpoint, areas classified as moderate ozone nonattainment areas are exempt from conformity if emissions of ROG are less than 50 tons per year and emissions of NOx are less than 100 tons per year.

Existing Air Quality Conditions

The existing air quality conditions in the proposed expansion area are characterized by air quality monitoring data collected in the region. PM10, CO, and ozone concentrations are measured at several north Bay monitoring stations. Recent monitoring data are presented in table 4-18. The closest monitoring station is located in San Rafael. A description of the major pollutants found in the expansion area is provided below.

Ozone

Ozone is a respiratory irritant and an oxidant that increases susceptibility to respiratory infections and can cause substantial damage to vegetation and other materials. Ozone is a severe eye, nose, and throat irritant. Ozone also attacks synthetic rubber, textiles, plants, and other materials. Ozone causes extensive damage to plants by leaf discoloration and cell damage.

State and federal standards for ozone have been set for a 1-hour averaging time. The state 1-hour ozone standard is 0.09 ppm, not to be exceeded more than 3 days in 3 years. The federal 1-hour ozone standard is 0.12 ppm, not to be exceeded more than 3 times in any 3-year period. The monitoring data has

Table 4-18. Ambient Air Quality Monitoring Data Recorded at San Rafael Monitoring Station

Pollutant Standards	1998	1999	2000
Ozone (O_3)			
Maximum 1-hour concentration (ppm)	0.074	0.102	0.071
No. Days Standard Exceeded			
NAAQS (1-hour) > 0.12 ppm	0	0	0
CAAQS (1-hour) > 0.09 ppm	0	2	0
Carbon Monoxide (CO)			
Maximum 8-hour concentration (ppm)	3.3	2.9	2.3
Maximum 1-hour concentration (ppm)	5.9	5.6	4.2
No. Days Standard Exceeded			
NAAQS (8-hour) $\geq$ 9.0 ppm	0	0	0
NAAQS (1-hour) $\geq$ 35 ppm	0	0	0
CAAQS (8-hour) $\geq$ 9.0 ppm	0	0	0
CAAQS (1-hour) $\geq$ 20 ppm	0	0	0
Particulate Matter (PM_{10})			
Maximum 24-hour concentration ($\mu g/m^3$)	52.4	75.6	39.5
2nd highest 24-hour concentration ($\mu g/m^3$)	39.8	64.4	38.7
Average arithmetic mean concentration ($\mu g/m^3$)	20.1	22.0	19.5
Average geometric mean concentration ($\mu g/m^3$)	18.7	19.5	18.1
No. Days Standard Exceeded			
NAAQS (24-hour) > 50 $\mu g/m^3$	0	0	0
CAAQS (24-hour) > 150 $\mu g/m^3$ [1]	1	2	0

[1]Recorded every six days.

Source: California Air Resources Board 2002; Environmental Protection Agency 2002

shown few instances where exceedances of the ozone state standard occurred during the 3 most recent years of available data.

Ozone is not emitted directly into the air, but is formed by a photochemical reaction in the atmosphere. Ozone precursors, which include ROG and oxides of nitrogen (NOx), react in the atmosphere in the presence of sunlight to form ozone. Because photochemical reaction rates depend on the intensity of ultraviolet light and air temperature, ozone is primarily a summer air pollution problem. The ozone precursors, ROG and NOx, are emitted by mobile sources and by stationary combustion equipment.

Carbon Monoxide

Carbon monoxide is essentially inert to plants and materials but can have significant effects on human health. Carbon monoxide is a public health concern because it combines readily with hemoglobin and thus reduces the amount of oxygen transported in the bloodstream. Effects on humans range from slight headaches and nausea to death.

State and federal CO standards have been set for both 1-hour and 8-hour averaging times. The state 1-hour standard is 20 parts per million (ppm) by volume, and the federal 1-hour standard is 35 ppm. Both state and federal standards are 9 ppm for the 8-hour averaging period. The monitoring data shows no recorded violations of the CO standards during the 3 most recent years of available data.

Motor vehicles are the dominant source of CO emissions in most areas. High CO levels develop primarily during winter when periods of light wind combine with the formation of ground-level temperature inversions (typically from the evening through early morning). These conditions result in reduced dispersion of vehicle emissions. Motor vehicles also exhibit increased CO emission rates at low air temperatures.

Particulates

Health concerns associated with suspended particulate matter focus on those particles small enough to reach the lungs when inhaled. Particulates can damage human health and retard plant growth. Particulates also reduce visibility, soil buildings and other materials, and corrode materials. The primary particulate of concern in the expansion area is PM10.

The state PM10 standards are 50 micrograms per cubic meter as a 24-hour average and 30 micrograms per cubic meter as an annual geometric mean. The federal PM10 standards are 150 micrograms per cubic meter as a 24-hour average and 50 micrograms per cubic meter as an annual arithmetic mean. The

monitoring data shows a few exceedances of the state PM10 24-hour standard during the 3 most recent years of available data.

PM10 emissions are generated by a wide variety of sources, including agricultural activities, industrial emissions, dust suspended by vehicle traffic, and secondary aerosols formed by reactions in the atmosphere.

Environmental Consequences and Mitigation Measures

Approach and Methods

The approach used in evaluation of air quality impacts is generally qualitative and follows requirements outlined by the BAAQMD. The BAAQMD's approach to analysis of construction impacts is to emphasize implementation of effective and comprehensive control measures rather than detailed quantification of emissions (Bay Area Air Quality Management District 1999). However, because of the requirement to prepare a general conformity analysis as required by EPA and BAAQMD, a quantitative evaluation of ozone precursors was conducted.

Impact Mechanisms

Impacts analyzed in this document include onsite construction emissions and emissions due to visitor or maintenance activity after the restoration activity is completed. Emissions associated with transport of dredged material to the site are not included as they are presumed to be analyzed in the environmental compliance documentation associated with dredging projects that may propose to use BMKV as a dredged material placement location.

Construction of the proposed wetland restoration may generate significant air emissions. Terrestrial construction-related emissions are generally short term but may still cause adverse air quality impacts. Fine particulate matter (PM10) is the pollutant of greatest concern with respect to terrestrial construction activities. PM10 emissions can result from a variety of construction activities, including excavation, grading, demolition, vehicle travel on paved and unpaved roads, and emission of vehicle and equipment exhaust. Terrestrial construction-related emissions of PM10 can vary greatly depending on the level of activity, the specific operations taking place, the equipment being operated, local soils, weather conditions and other factors. Construction-related emissions can cause substantial increases in localized concentrations of PM10. Particulate emissions from construction activities can lead to adverse health effects, as well as nuisance

concerns such as reduced visibility and soiling of exposed surfaces (Bay Area Air Quality Management District 1999).

In addition, PM10 emissions could be generated from the dredged material as it dries, prior to breaching of the levees.

Terrestrial construction equipment emits CO and ozone precursors. However, these emissions are included in the emission inventory that is the basis for the regional air quality plans. Terrestrial construction equipment activities are not expected to impede attainment or maintenance of ozone and CO standards in the Bay Area (Bay Area Air Quality Management District 1999). Impacts on CO are assumed to be less than significant and are not evaluated further. Ozone precursors are evaluated in the general conformity analysis.

Use of diesel pumps and associated equipment to off-load and pump dredged material from offshore into the expansion site could also result in the emission of ozone precursors.

At full function, the proposed BMKV expansion would generate air emissions related to visitor use and maintenance activities. Because visitor use and periodic maintenance activities would be limited, impacts on air emissions from visitor use and maintenance activities are considered less than significant.

Thresholds of Significance

The following significance criteria were used to evaluate the proposed BMKV expansion. Regarding air quality, the proposed expansion was identified as resulting in a significant impact on the environment if it would

- allow uncontrolled emissions of PM10; or
- result in annual emissions exceeding EPA and BAAQMD conformity thresholds (50 tons ROG per year or 100 tons NOx per year).

Impacts and Mitigation Measures of No-Action Alternative

Under the No-Action Alternative, the expansion area would not be used as a wetland restoration site and existing uses are expected to continue. Because no changes in activities are expected under the No-Action Alternative, no change in PM10, CO, or ozone precursors would occur.

Impacts and Mitigation Measures Common to Alternatives 1–3

Impact A-1: Construction-Related Emissions of PM10 from Terrestrial Construction Equipment

As described above under *Impact Mechanisms*, implementation of the proposed BMKV expansion would result in PM10 emissions, resulting from grading and other ground-disturbing activities required for site preparation, dredged material placement, and other restoration activities. This impact would be considered significant. To reduce this impact to a less-than-significant level, the following mitigation measure would be implemented:

Mitigation Measure A-1: Control PM10 Emissions in Accordance with BAAQMD Standards.

Basic Control Measures – The following controls should be implemented at all construction sites.

- Water all active construction areas at least twice daily.
- Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least 2 feet of freeboard.
- Pave, apply water 3 times daily, or apply (nontoxic) soil stabilizers on all unpaved access roads, parking areas, and staging areas at construction sites.
- Sweep daily (with water sweepers) all paved access roads, parking areas and staging areas at construction sites.
- Sweep streets daily (with water sweepers) if visible soil material is carried onto adjacent public streets.

Enhanced Control Measures – The following measures should be implemented at construction sites greater than 4 acres in area.

- Hydroseed or apply (non-toxic) soil stabilizers to inactive construction areas (previously graded areas inactive for 10 days or more).
- Enclose, cover, water twice daily, or apply (non-toxic) soil binders to exposed stockpiles (dirt, sand, etc.).
- Limit traffic speeds on unpaved roads to 15 mph.
- Install sandbags or other erosion control measures to prevent silt runoff to public roadways.
- Replant vegetation in disturbed areas as quickly as possible.

Optional Control Measures – The following control measures will be considered for use at construction sites that are large in area, located near

sensitive receptors, or which may warrant additional emissions reductions for any other reason.

- Install wheel washers for all exiting trucks, or wash off the tires or tracks of all trucks and equipment leaving the site.
- Install wind breaks, or plant trees/vegetative wind breaks at windward side(s) of construction areas.
- Suspend excavation and grading activity when winds (instantaneous gusts) exceed 25 mph.
- Limit the area subject to excavation, grading, and other construction activity at any one time.

Impact A-2: Construction-Related Emissions of Ozone Precursors from Terrestrial Equipment and Equipment Associated with Offloading of Dredged Material

An emissions estimate for construction activity was developed to analyze the general conformity of the proposed BMKV expansion. This conformity analysis is presented in appendix E. The estimate for terrestrial construction activity (other than activity associated with off-loading of dredged material) identifies that the alternatives could generate emissions of up to 1.7 tons per year of ROG and 25.2 tons per year of NOx during the onshore construction activity.

Emission estimates were also developed for equipment associated with off-loading of dredged material. Dredged material would arrive by barge at the offshore off-loading facility. Off-loading of dredged material would involve the use of supporting marine vessels and other equipment, as well as hydraulic pumping of the dredged material to the HWRP sites, including the BMKV site. Several options for pumping are being considered, including use of electrically driven pumps, use of diesel-fired pumps, and combinations of the two. Electrically driven pumps would not generate any site-related emissions by themselves. Diesel pumps, marine vessel engines, and associated equipment (like generators) would generate NOx in addition to other priority pollutants. For this analysis, only emissions for NOx were estimated as an indicator of pumping equipment that may pose a regulatory concern. The emissions estimate includes off-loader pumps, generators, a work tug at the off-loader facility, a crew boat, a loader, and several hydracranes and bulldozers that would assist with the pumping activity.

Three different scenarios reflecting different levels of annual dredged material (low—0.5 million cubic yards [mcy], medium—1.25 mcy, and high—3.5 mcy) were evaluated to reflect a range of possible dredged material delivery volumes to the BMKV site. The emissions estimate is summarized in table 4-19 and presented in appendix E. The following 5 configurations were evaluated.

Table 4-19. Off-loading Activity NOx Emissions Summary, BMKV Expansion (annual tons)

Scenario (Annual mcy)	Low (0.5 mcy)	Medium (1.25 mcy)	High (3.5 mcy)
Diesel Unmitigated	68.9	138.4	346.8
Diesel Mitigated	40.4	66.7	145.6
Electrified	6.8	17.0	47.8
Diesel Off-loader (unmitigated)/ Elec. Booster	35.6	70.1	173.3
Diesel Off-loader (mitigated)/ Elec. Booster	23.9	40.7	91.2
BAAQMD Conformity Threshold for NOx = 100 tons/year			

Source: Moffatt, Nichol 2002

- Diesel Unmitigated – The unmitigated case assumed all equipment to be diesel-powered with engines typical of existing equipment.
- Diesel Mitigated – The mitigated case assumed that emission reduction technology would be implemented on the main engines of the off-loader and booster pump only. Emission reduction was based on the use of selective catalytic reduction (SCR) to the engines.
- Electrified – This case assumed that the off-loader and booster pumps are electric.
- Electrified Booster/Diesel Off-loader – This case was a hybrid of the unmitigated case and the electrified case.
- Electrified Booster/Diesel Off-loader (mitigated) – This case was a hybrid of the mitigated case and the electrified case.

In the diesel unmitigated case, the emissions estimate in the medium and high scenarios would be above the conformity threshold of 100 tons. In the diesel mitigated case, only the emissions associated with the high scenario would exceed the threshold. NOx emissions in the electrified case were below the threshold for all three scenarios. Emissions in the hybrid unmitigated case were above the threshold only for the high scenario. NOx emissions in the hybrid mitigated case were below the threshold for all 3 scenarios.

Depending on the choice of equipment and power source (diesel or electric) and upon the amount of dredged material pumped per year, NOx emissions could exceed the conformity threshold and result in a significant impact on air quality. To reduce this impact to a less-than-significant level, Mitigation Measure A-2 would be implemented

Mitigation Measure A-2: Control and/or Offset NOx Emissions Associated with Off-loading Dredged Material.
One or more of the following options will be implemented in order to mitigate NOx emissions to a less-than-significant level.

- **Option 1** – Use electric power for the off-loader and booster pumps.
- **Option 2** – Use SCR for the diesel off-loader and booster-pump engines, and limit annual pumping activity to a level that will result in emissions below the conformity thresholds.
- **Option 3** – Use electric power for the booster-pump engines and SCR for the diesel off-loader pump engine
- **Option 4** – Use electric power for the booster-pump engines, and limit annual pumping activity to a level that will result in emissions below the conformity thresholds.
- **Option 5** – Use diesel pumps, and limit annual pumping activity to a level that will result in emissions below the conformity thresholds. Based on the

emissions estimate prepared, this annual volume limit would be approximately 1 mcy/year.

- **Option 6** – Pursue an engine retrofit program for locally operated tugboats in order to compensate for potential exceedance(s) of the conformity levels.
- **Option 7** – Purchase offsetting mitigation credits from other regulated entities.

With implementation of this mitigation, this impact to air quality is considered less than significant.

Noise

Affected Environment

This section evaluates noise impacts associated with the proposed BMKV expansion. Construction noise would be the only notable source of noise associated with restoration. Use or maintenance of the restoration site would not generate significant noise.

Data Sources and Terminology

The *Hamilton Wetland Restoration Plan Final EIR/EIS* (Jones & Stokes 1998) provided the basis for this discussion.

The following are brief definitions of acoustical terminology used in the analysis of noise impacts.

Sound – A vibratory disturbance created by a vibrating object which, when transmitted by pressure waves through a medium such as air, is capable of being detected by a receiving mechanism such as the human ear or a microphone.

Noise – Sound that is loud, unpleasant, unexpected, or otherwise undesirable.

Ambient Noise – The composite of noise from all sources near and far in a given environment exclusive of particular noise sources to be measured.

Decibel, dB – A unitless measure of sound on a logarithmic scale which indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micro-Pascals.

A-Weighted Decibel, dBA – An overall frequency-weighted sound level in decibels which approximates the frequency response of the human ear.

Equivalent Sound Level, Leq – The equivalent steady state sound or vibration level which in a stated period of time would contain the same acoustical or vibration energy.

Percentile Exceeded Sound Level, Lxx – The sound level exceeded a specified percentage of the measurement duration. For L_{10} is the sound level exceeded 10 percent of the time and L_{90} is the sound level exceeded 90 percent of the time.

Day-Night Level, Ldn –The energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the A-weighted sound levels occurring during the period from 10 p.m. to 7 a.m.

In general, human sound perception is such that a change in sound level of 3 dB is generally perceived as being just noticeable, a change of 5 dB is clearly noticeable, and a change of 10 dB is perceived as a doubling or halving of sound level.

Noise-Sensitive Land Uses in the Expansion Area

Noise-sensitive land uses are generally defined as locations where people reside or where the presence of unwanted sound could adversely effect the use of the land. Noise-sensitive land uses typically include residences, hospitals, schools, guest lodging, libraries, and certain types of recreational uses. The existing and potential future noise-sensitive uses in the expansion area include the following.

- The BMK residential development, located north of the restoration site (construction activity on or adjacent to the south lagoon levee on the northern perimeter of BMKV could occur within 150 to 300 feet from the nearest residences to the south lagoon levee; most construction would occur further from the BMK residential community on other portions of BMKV)
- The Hamilton residential development, located south of the restoration site (construction activity along the southern HAAF–BMKV perimeter would be within about 1,250 feet, at the closest, to this development)
- Public uses of the future Bay Trail

Existing Noise Conditions

Ambient sound levels associated with noise-sensitive land uses in the vicinity of the expansion site vary depending on the proximity of major existing noise sources such as traffic, aircraft, and industrial uses. Ambient sound levels in similar suburban/rural settings are typically in the range of 40 to 60 dBA. Noise levels were measured in 1991as part of the 1993 EIR prepared for the prior proposed development at BMKV (see table 4-20). Development in the BMK community or on the BMKV property itself has not changed since 1991, so these

measurements are felt to reasonably represent the ambient noise levels present at the site.

Table 4-20. Measured Noise Levels at Selected Locations in the Expansion Area

Location	Duration (hours)	Leq (dBA)	Lmax (dBA)
Center of BMKV	0.25	48	62
Eastern Tip of BMK III	0.25	47	58
Entrance to Site (15 m from BMK Blvd.)	0.30	55	74
Southern property boundary (HAAF/BMKV)	24	52	80

Source: ESA 1993

Noise Standards and Regulation

Various federal, state, and local agencies have developed guidelines for evaluating land use compatibility under different sound-level ranges. These guidelines are summarized below:

Federal Guidelines

The federal Noise Control Act of 1972 established a requirement that all federal agencies administer their programs to promote an environment free of noise that jeopardizes public health or welfare. The EPA was given the responsibility for:

- providing information to the public regarding identifiable effects of noise on public health or welfare,
- publishing information on the levels of environmental noise that will protect public health and welfare within an adequate margin of safety,
- coordinating federal research and activities related to noise control, and
- establishing federal noise-emission standards for selected products distributed in interstate commerce.

The EPA identified indoor and outdoor noise limits to protect against effects on public health and welfare. Outdoor limits of 55 dB-Ldn and indoor limits of 45 dB-Ldn are identified as desirable to protect against speech interference and sleep disturbance for residential areas and areas with educational and healthcare facilities.

The U.S. Department of Housing and Urban Development has established guidelines for evaluating noise impacts on residential projects. Sites are

generally considered acceptable if they are exposed to outdoor noise levels of 65 dB-Ldn or less, normally unacceptable if they are exposed to levels of 65–75 dB-Ldn, and unacceptable if exposed to levels of 75 dB-Ldn or greater.

State Guidelines

In 1987, the California Department of Health Services published guidelines for the noise elements of local general plans. These guidelines include a sound level/land use compatibility chart that categorizes various outdoor Ldn ranges by land use. These guidelines identify the normally acceptable range for low-density residential uses as less than 65 dB and conditionally acceptable levels as 55–70 dB.

Local Guidelines

The Marin County General Plan (1994) established noise level performance standards for stationary sources for areas within the county. Table 4-21 summarizes the county's standards. However, it should be noted that there would be no stationary noise sources associated with the restoration after construction is completed. During construction, there would be mobile sources associated with vehicles but no fixed stationary sources other than the electrical off-loading pumps which would be located in San Pablo Bay, far from any sensitive receptor.

Table 4-21. Allowable Noise Exposure from Stationary Noise Sources in Marin County

	Daytime (7:00 a.m. to 10:00 p.m.)	Nighttime (10:00 p.m. to 7:00 a.m.)
Hourly dB (L_{eq})	50	45
Maximum Level	70	65
Maximum level (Impulsive Noise)	65	60

Source: Marin Countywide Plan, 1994

Marin Countywide Plan policy N-2.4 requires measures to be taken to minimize the exposure of neighboring properties to excessive noise levels from construction-related activity. Under Program N-2.4a, the Marin County Community Development Department reserves the right to set hours for construction-related activities that involve the use of machinery, power tools, or hammering. The Marin Countywide Plan identifies, in general, that residential areas should not be exposed to sound levels greater than 60 dBA. However, this

guidance is primarily concerned with the location of new development, rather than temporary construction noise.

The City of Novato's General Plan (1999) has established the following noise level performance standards for areas within the city. Table 4-22 summarizes the city's standards. The city's Noise Ordinance prohibits noise between the hours of 10:00 p.m. and 6:00 a.m. The BMKV site is not within the City of Novato, but the Hamilton residential development is within the city limits.

Table 4-22. City of Novato Noise and Land Use Compatibility Standards

Land Use Category	Maximum allowable noise level
Residential Development	Up to 60 dB
Transient Lodging: Motel and Hotel	Up to 60 dB
School, Library, Church, Hospital and Nursing Home	Up to 60 dB
Auditorium, Concert Hall, Amphitheater	Up to 70 dB
Sports Arena, Outdoor Spectator Sports	Up to 70 dB
Playgrounds, Neighborhood Parks, Open Space	Up to 65 dB
Golf Course, Cemetery	Up to 70 dB
Office Building, Business, Commercial & Professional	Up to 70 dB
Industrial, Manufacturing, Utilities	Up to 70 dB

Source: City of Novato General Plan 1999

Environmental Consequences and Mitigation Measures

Approach and Methods

Noise impacts were evaluated by comparison of anticipated noise levels with reference noise levels developed by EPA, the distances to sensitive noise receptors, and local noise guidelines. Noise levels were measured in A-weighted decibels (dBA), a composite frequency-weighting scheme that approximates the way the human ear responds to sound levels.

Impact Mechanisms

Construction activities associated with restoration could intermittently generate elevated noise levels on and adjacent to construction sites within the expansion area. Offshore pile-driving activity associated with potential off-loader and

booster-pump platforms is discussed separately from onshore construction activity.

Onshore construction activities associated with the restoration would include demolition, grading and earthmoving activities, hauling materials, building structures, and pumping activities. Existing noise-sensitive land uses located in the vicinity of the construction activity could be exposed to construction noise.

Table 4-23 summarizes typical noise levels produced by onshore construction equipment commonly used for development of wetland restoration sites. As indicated, equipment involved in construction is expected to generate noise levels ranging from 76 dB to 89 dB at a distance of 50 feet. Noise produced by construction equipment would be reduced at a rate of about 6 dB per doubling of distance.

Table 4-23. Construction Equipment Noise Emission Levels

Equipment	Typical Noise Level (dBA) 50 ft from Source
Backhoe	80
Compactor	82
Crane, Derrick	88
Crane, Mobile	83
Dozer	85
Grader	85
Loader	85
Paver	89
Pump	76
Scraper	89
Truck	88

Source: Federal Transit Administration 1995.

A reasonable worst-case assumption for onshore construction is that the 3 loudest pieces of equipment would operate simultaneously and continuously over at least a 1-hour period. The combined sound level of 3 of the loudest pieces of equipment listed in table 4-23 (paver, scraper, and truck) is 93-dBA measured at 50 feet from the source. Table 4-24, which assumes this combined source level, summarizes predicted noise levels at various distances from an active construction site. These estimations of noise levels take into account distance attenuation, attenuation from molecular absorption, and anomalous excess attenuation (Hoover 1996). The results in table 4-24 indicate that the resultant worst-case sound levels of greater than 60 dBA could occur within about 1,500

feet. Operation of a single piece of equipment, such as a scraper, could result in sound levels greater than 60 dBA within about 1,000 feet.

Table 4-24. Estimated Onshore Construction Noise in the Vicinity of an Active Construction Site

Distance Attenuation	Sound Level at Receptor (dBA)	
Distance to Receptor (feet)	Combined Equipment	Single Piece of Equipment (e.g. Scraper)
50	93	89
100	87	83
200	81	77
500	72	68
600	71	66
800	68	64
1,000	65	61
1,500	61	57
2,000	58	54
2,500	55	51
3,000	52	48
4,000	48	44
5,280	44	40
7,500	37	33

The following assumptions were used:		
Basic sound level drop-off rate:	6.0	dB per doubling of distance
Molecular absorption coefficient:	0.7	dB per 1,000 feet
Anomalous excess attenuation:	1.0	dB per 1,000 feet
Reference Sound Level (Combined)	93	dBA
Reference Sound Level (Single)	89	dBA
Distance for Reference Sound Level:	50	Feet

Notes:

This calculation does not include the effects, if any, of local shielding, which may reduce sound levels further.

Pile-driving may be conducted offshore for the off-loader and booster-pump platforms. Approximately thirty 36-inch diameter piles may be driven over a 1-month period using a pile-driving hammer with a power of approximately 110 to 220 kJ. The off-loading facility would be located approximately 30,000 feet

from the expansion restoration site, at approximately the –24- to –28-foot MLLW. The booster-pump platform would be located offshore between the off-loading facility and the shoreline. Impact pile drivers can have typical noise levels in excess of 100 dBA at 50 feet, depending on size (Federal Transit Administration 1995).

Thresholds of Significance

The following significance criteria were used to evaluate the proposed BMKV expansion. Regarding noise, the proposed expansion was identified as resulting in a significant impact on the environment if it would

- increase noise levels to greater than 60 dBA in residential areas adjacent to the site, or
- increase noise levels by 3 dBA in areas where noise levels already exceed 60 dBA.

Impacts and Mitigation Measures of No-Action Alternative

Under the No-Action Alternative, construction of the proposed BMKV expansion would not occur, and no new noise sources would be created.

Impacts and Mitigation Measures Common to Alternatives 1–3

Impact N-1: Potential Increases in Traffic Noise Levels

Implementation of the proposed BMKV expansion would result in increases in traffic associated with construction and operation of the restoration site. Because materials for levee construction are available onsite, traffic generated during the construction phase would consist primarily of workers commuting to the site. The low number of these daily trips is not expected to affect noise conditions in the area crossed by the proposed access easement. Therefore, the impact on sensitive noise receptors as a result of increased traffic during the construction is considered less than significant.

After the construction of the BMKV expansion is completed, traffic on the site would consist of trips made for maintenance and monitoring purposes in addition to recreational users. Trips made for maintenance and monitoring purposes would be infrequent and would not affect post-construction noise levels. Although no formal recreation use plan has been developed for the site, the number of trips made for recreational purposes is not expected to substantially

increase. Therefore, the impact on sensitive noise receptors as a result of increased traffic during operation is considered less than significant.

Impact N-2: Temporary Increases in Noise Levels to more than 60 dBA during Onshore Construction

As described above, implementation of the proposed BMKV expansion could result in temporary noise levels exceeding 60 dBA at distances up to 1,500 feet due to combined equipment activity and at distances up to 1,000 feet from single equipment activity associated with grading and other ground disturbing construction activities. Most of the BMKV site is below grade because of subsidence; restoration construction activity within the center of the site is likely to be below the elevation of the perimeter levees. However, construction activity on the northern or southern levees could be on a similar elevation to nearby residences in the BMK and Hamilton residential areas.

Sensitive noise receptors during construction include residences in these 2 areas. Construction activity could occur in the range of 150–300 feet from the nearest BMK residence when working on or near the south lagoon levee and within 1,250 feet from the nearest Hamilton residences when working on the HAAF–BMKV levee. Due to the distance to the Hamilton residential development and the existence of the New Hamilton Partnership levee (elevation 8 to 12 feet NGVD) on the western side of the former airstrip, no significant impacts are expected for the Hamilton residences. Although the impact to some of the nearest BMK residences would be temporary, this impact is considered significant. To reduce this impact to a less-than-significant level, the following mitigation measure would be implemented:

Mitigation Measure N-1: Employ Noise-Reducing Construction Practices.

To reduce noise levels to the maximum extent practicable, the wetland construction contractor will employ the following noise-reducing construction practices.

- During construction phases, the contractor will ensure that construction is performed in accordance with applicable City and County noise standards. No noise generating construction or repair work within 1,000 feet of residences will be performed between the hours of 10:00 p.m. and 7:00 a.m. on any weekday, Sunday, or legal holiday.
- During construction phases, earthmoving within 300 feet of an occupied residence will only be performed during normal daylight hours (8:00 a.m. to 5:00 p.m.), Monday through Saturday, wherever feasible.
- Mufflers should be kept operable and effective on all construction equipment, generators, and vehicles. All internal combustion engines must be operated with exhaust and intake silencers. Wherever possible, noise-

generating construction equipment should be shielded from nearby residences by noise-attenuating buffers such as structures or truck trailers.

- Prior to construction within 1,000 feet of residences, written notice should be provided to potentially affected residences identifying the type, duration, and frequency of construction activities. Notification materials will also identify a mechanism for residents to register complaints if construction noise levels are overly intrusive or construction occurs outside the required hours.

- Construction staging area(s) and stockpile areas will be located at least 1,000 feet from occupied residences, or contractors will be required to provide appropriate noise-reducing engine-housing enclosures. Equipment warm-up areas, water tanks, and storage areas should be located in the established staging area or in other portions of the expansion site more than 1,000 feet from existing residences as feasible.

- Throughout the construction period, the contractor will implement appropriate additional noise mitigation measures, including, but not limited to, changing the location of stationary construction equipment, shutting off idling equipment, rescheduling construction activity, or installing temporary barriers around stationary construction noise sources at the request of the City or County.

Impact N-3: Temporary Increase in Noise Levels due to Offshore Pile-Driving

Pile-driving may be conducted offshore as part of construction of the off-loading facility and the booster-pump platform. The off-loading facility would be located more than 1 mile from the nearest shoreline and any associated residences. Assuming the pile-driving equipment resulted in an impulse noise level of 101 dBA at 50 feet, the noise level of pile driving would attenuate to less than 60 dBA within 4,800 feet of the pile-driving location, which is not near any residential areas. This impact is considered less than significant. Impacts to marine mammals and sensitive fish species is discussed separately above in the *Biological Resources* section of this chapter.

Impacts and Mitigation Measures Unique to Alternatives 1 and 2

Impact N-4: Increased Noise from Use of Hydraulic Off-Loaders and Supplemental Booster Pumps

Under Alternative 1, electric-powered or diesel-powered hydraulic off-loaders would be located approximately d 24,000 feet (4.5 miles), respectively, offshore. The equipment would not contribute significantly to ambient noise levels onshore

because of their relatively low noise level during operation and due to their relative distant location from sensitive receptors onshore. Similarly, electric-powered or diesel-powered supplemental booster pumps, which would also be located offshore, would not contribute significant increases in the ambient noise levels onshore. Because of the distance between the off-loaders and sensitive noise receptors, noise levels at sensitive receptors would be fall below desirable limits. The impact on sensitive noise receptors as a result of off-loading equipment during construction is considered less than significant.

Cultural Resources

Introduction

An archaeological and architectural investigation was conducted in compliance with the requirements of CEQA, NEPA, and Section 106 of the National Historic Preservation Act (NHPA) for the proposed BMKV expansion. This section represents the results of the cultural resources investigation.

Data Sources

A records search conducted at the Northwest Information Center of the California Historical Resources Information System resulted in the identification of several prehistoric archaeological sites that have been recorded within a 0.5-mile radius of the expansion area (Nelson 1909). However, no prehistoric archaeological sites have been identified in the proposed expansion area. Previous studies within the area of potential effect (APE) (Archaeological Consulting and Research Services 1979, Flynn 1978, Shannon 1992) did not result in the identification of prehistoric resources. There are many previously recorded prehistoric sites close to the expansion area, all of which have been found on the low terraces, at a slight elevation above sea level (Nelson 1909). In 1909, Nelson reported on several sites located north and south of the expansion area. These sites are primarily prehistoric occupation sites and locations where the native population procured food and other resources. Shannon (1992) identified several historic and architectural resources within the expansion area and provided some indication for sensitivity.

A letter was sent to the Native American Heritage Commission (NAHC) requesting that they consult their sacred lands file and send a list of individuals and organizations that may have knowledge of properties of cultural or religious importance to Native Americans in the expansion area. The search of the sacred lands file revealed no Native American cultural properties within the expansion area, and a letter was sent to each individual and organization identified on the NAHC list. To date, no responses have been received.

In an effort to identify important historic people, events, and architectural trends that may have been associated with the expansion area, a cultural resources specialist conducted archival research at various repositories, including the County of Marin assessor's office; the County of Marin recorder's office; the California State Library, Sacramento; the Division of Mines and Geology Library, Sacramento; the Marin County Civic Center Library; and the Novato History Museum. Previous reports consulted include the *Hamilton Wetland Restoration Plan Final EIR/EIS* (Jones & Stokes 1998); *National Register of Historic Places Evaluation, Hamilton Army Air Field Historic District, Marin County, California* (PAR Environmental Services, Inc. 1993); the *Bel Marin Keys V Final EIR/EIS, Marin County, California* (Environmental Science Associates 1993); and the *Archaeological Impact Evaluation of Two Non-Contiguous Parcels of Land Near Ignacio, Marin County* (Archaeological Resource Service 1978).

Field Survey

An archaeologist visited the proposed expansion area on January 17 and 18, 2002 and on February 25, 2002. The archaeologist conducted the field survey in a manner that would allow a view of all portions of the proposed expansion area. The levees were walked in a linear circumference of the property. Areas around historic structures and suspected historic activity were investigated in intensive transects spaced no farther than 10 meters apart.

On January 9, 2002, an architectural historian conducted a field survey of the expansion area comprising the BMKV parcel and the SLC parcel. As part of the field process, buildings and structures in the APE were inspected and photographed, and notes were gathered. This survey did not include the proposed Bay Trail route in Alternative 1.

Determination of Significance of Cultural Resources

Historical resources are defined as buildings, sites, structures, objects, or districts, each of which may have historical, architectural, archaeological, cultural, or scientific significance.

Prior to the assessment of effects or the development of mitigation measures, the significance of cultural resources must be determined. The steps that are normally taken in a cultural resources investigation for CEQA compliance are:

- identify potential historical resources,
- evaluate the eligibility of historical resources,
- evaluate the effects of a project on all eligible historical resources.

Because the federal trigger for NEPA also triggers Section 106 of NHPA (36 CFR et. seq.), the 2 compliance processes can be coordinated.

Section 106 of the NHPA requires that, before beginning any undertaking, a federal agency must take into account the effects of the undertaking on historic properties and afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on these actions. The Section 106 process has 6 basic steps.

- Initiate consultation and public involvement
- Identify and evaluate historic properties
- Assess effects of the project on historic properties
- Consult with the State Historic Preservation Officer (SHPO) regarding adverse effects on historic properties, resulting in a memorandum of agreement (MOA)
- Submit the MOA to the ACHP
- Proceed in accordance with the MOA

The assessment of impacts presented in this section applies the Criteria of Effect and Adverse Effect, as defined by the NHPA. Because these criteria are consistent with the criteria for determining impacts for both CEQA and NEPA, this section will be used to document the effects of the proposed wetland restoration for the purpose of CEQA, NEPA, and Section 106. 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 (in this case, the Corps) is ultimately responsible for ensuring that the Section 106 process is completed according to statute.

Cultural Resource Significance Criteria

CEQA guidelines define 3 ways that a property can qualify as a significant historical resource for the purposes of CEQA review.

- If the resource is listed in or determined eligible for listing in the California Register of Historical Resources (CRHR)
- If the resource is included in a local register of historic resources, as defined in section 5020.1(k) of the Public Resources Code, or identified as significant in a historic resource survey meeting the requirements of section 5024.1(g) of the Public Resources Code unless the preponderance of evidence demonstrates that it is not historically or culturally significant
- If the lead agency determines the resource to be significant as supported by substantial evidence in light of the whole record (California Code of Regulations, Title 14, Division 6, Chapter 3, section 15064.5)

For a historic resource to be eligible for listing in the CRHR, it must be significant at the local, state, or national level under 1 or more of the following 4 criteria.

- It is associated with events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States.
- It is associated with the lives of persons important to local, California, or national history.
- It embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of a master, or possesses high artistic values.
- It has yielded, or has the potential to yield, information important to the prehistory or history of the local area, California, or the nation.

Historic resources automatically listed in the CRHR include those historic properties listed in, or formally determined eligible for listing in, the NRHP (PRC section 5024.1).

Because the proposed wetland restoration must comply with NEPA and Section 106 of the NHPA, federal significance criteria are also applied in the following analysis. For federal projects, cultural resource significance is evaluated in terms of eligibility for listing in the NRHP. NRHP criteria for eligibility are defined as follows:

The quality of significance in American history, architecture, archeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling and association, and that:

- are associated with events that have made a contribution to the broad pattern of our history;
- are associated with the lives of people significant in our past;
- embody the distinct characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- have yielded, or are likely to yield, information important in prehistory or history (36 CFR 60.4).

Affected Environment

Prehistory

Nels C. Nelson was the first archaeologist to survey the coastline of San Francisco Bay. Nelson's survey, which included the Marin Coast, was conducted between 1906 and 1908 and documented 425 shellmounds along the coast from the Russian River in Sonoma County to Half Moon Bay in San Mateo County (Nelson 1909). Numerous shellmounds occur within a short distance of the proposed expansion area—to the north and south. Nelson's primary concerns were the distribution, condition, number, and constituents of the shellmounds, which might infer the age and amounts of inhabitants who occupied the sites (Moratto 1974: 63; Nelson 1909). Nelson also recognized the intensive use of shellfish throughout the coastal middens as evidence for a distinct economic base of the region (Moratto 1984: 227). Nelson also performed the first investigations at 3 shellmounds in eastern Marin County in 1909 and 1910.

By 1916, 11 of the sites identified by Nelson had been excavated. Advances were made in archaeological dating methods, and in the 1930s, researchers applied these new techniques to distinguish temporally and culturally discrete assemblages of shell beads and ornaments. More recently, new techniques were developed for determining obsidian sources and exchange routes among different Native American groups throughout California and beyond. In addition, obsidian hydration and radiocarbon dating have been instrumental in establishing dates of occupation for many of the sites within San Francisco Bay Area. Information on human occupation prior to 5000 B.P. is almost non-existent because of the depositional environment of the region and dramatic environmental changes which took place their at this time.

Results from previous archaeological investigations within the expansion area and the surrounding region have shown that the San Francisco Bay Area was inhabited by mobile hunter-gatherers. Over time, their foraging strategies became more focused on the locally obtainable resources, and their lives became increasingly more sedentary. Early inhabitants of the expansion area relied heavily on the resources associated with San Pablo Bay and associated marshes and estuarine environments. Several archaeological sites associated with past use are found near the expansion area and generally inland of the expansion site; most are situated above the historic marshlands.

The vast majority of the expansion area is comprised of agricultural fields, which were once marshland prior to the construction of the levees in the early part of the 20th century. For the past several thousand years, the property existed as tidal marshlands. Before that time, when sea levels of the San Francisco Bay were considerably lower than they are today (Bickel 1978), the prehistoric environmental setting of the area was very different. Prior to the marshland environment, the sea level was considerably lower, and therefore the expansion area could well have been a littoral zone where Native Americans lived and procured marine and bayshore resources. Inundation and sedimentation

associated with sea level rise resulted in subsequent deposition of bay mud on the expansion site. Based on cone penetrometer testing conducted in 1991, the depth of bay mud across the site is between 28 and 99 feet (Environmental Science Associates 1993). It is possible that due to the prehistoric use of the site when it was a littoral zone, prehistoric archaeological resources may be present beneath the bay mud layer.

Ethnography

The expansion area was inhabited by the Coast Miwok Indians in the prehistoric past and at the time of European contact. The Coast Miwok language, a member of the Miwokan subfamily of the Utian family, is divided into 2 dialect groups: Western (Bodega) and Southern (Kelly 1978: 414; Shipley 1978: 84). The Coast Miwok territory extended from Duncan's Point on the Sonoma County Coast to the end of the Marin County Peninsula (Kroeber 1925). To the east, Coast Miwok territory extended east as far as midway between the Sonoma and Napa Rivers (Kelly 1978).

The main tribelet in the expansion area was the Omiomi group, which inhabited the valley of Novato Creek on the northwest side of San Pablo Bay (Milliken 1995: 250). The Coast Miwok village of Puyuku is also situated within 1 mile of the expansion site. Coast Miwok villages were usually located near major inland watercourses or, in some cases, along the coast (Kelly 1978: 417).

Contact between the Coast Miwok and Europeans first occurred on the Marin County coast as early as 1579, when Sir Francis Drake spent 5 weeks on the Marin coast to repair his damaged ship (Kroeber 1953: 275). Spanish explorers made contact with the Coast Miwok in the late 1700s. By 1776, the Franciscan fathers of the San Francisco mission began forced conversions of Native Americans to Christianity and brought Coast Miwok to mission lands, causing a partial abandonment of native settlements. Subsequent ranching and settlement by Mexicans and Americans further displaced Coast Miwok from their homes and subjected the group to intense depredations of homicide and epidemic diseases (Bean and Rawls1993: 17).

During the early years of U.S. dominance of California, some Coast Miwok took work in sawmills and as field hands (Kelly 1978: 414). Although the Coast Miwok population declined from approximately 2,000 persons before European contact to 5 individuals by 1920 (Cook 1976: 239), the National Park Service, the Miwok Archaeological Preserve, and individuals of at least partial Coast Miwok descent began recreating the village of Kule Loklo (Bear Valley) on the Point Reyes National Seashore. Dances and local festivals reflecting Coast Miwok traditions are now held at Kule Loklo (Eargle 1986: 67, 84–85). Additional ethnographic information about the Coast Miwok is included in a technical report (Jones & Stokes 2002).

History

Marin County was one of the original 27 counties created when California became a state in 1850. It is dotted with numerous dairy farms, as well as poultry and stock-raising ranches. The Golden Gate National Recreational Area also makes up a sizeable portion of the county (Hart 1978: 259).

As early as the 1500s, Europeans such as Frances Drake and Sebastian Rodriguez Cermeno explored the region. Spain established Mission San Rafael in present-day San Rafael in 1817. After 1822, Mexico gained independence from Spain and began allowing its citizens land grants throughout Alta California. In 1848, the United States defeated Mexico in the Mexican-American War and Mexico surrendered its Alta California land in the Treaty of Guadalupe Hidalgo. Livestock grazing in addition to agricultural and dairy farming comprised the principal industries during this period (Hoover 1990: 172–174, Mason 1975: 156).

Once California became a state, it assumed ownership of much of the land within its borders including lands under navigable streams, lakes, or harbors, land acquired through purchase, condemnation, or gift, or that which was obtained through rancho land title disputes. In addition, through the Swampland Act of September 28, 1850 (also known as the Arkansas Act), the federal government granted California public land throughout the state (amounting to over 2-million acres) that was subject to overflow and therefore unprofitable for agricultural use unless reclamation work was undertaken (Robinson, 1948: 191–192). With federal assistance, the swamp and overflow land was identified, surveyed, certified, and then patented to the state. The state, in turn, issued a state patent to future swampland purchasers.

The expansion area, a historic marshland, was part of this swamp and overflow acreage. California issued patents for land within the APE in 1863 to Henry Hansen and in 1876 to L.C. McAfee (Marin County Recorder's Office 1868:187–189, 1876b: 565). E. B. Perrin eventually assumed ownership of Hansen and McAfee's property and sold it to John W. Ferris by 1878 (Shannon 1992). In 1892, John W. Ferris a civil engineer and swampland developer from the Central Valley, increased his land holdings by purchasing over 500 additional acres of swampland (including the expansion area) along San Pablo Bay. The state issued a patent to Ferris for his land in 1893 (Dodge 1892, Marin County Recorder's Office 1893: 189).

Although Ferris owned vast amounts of acreage in the area, there is no evidence that he actually resided in Marin County. In 1906, he married Emma Watson, daughter of Claus Spreckels (a sugar tycoon) and moved to England (*San Francisco Chronicle* 1920). Ferris retained ownership of his Marin County property, including the study area, until 1912 when he sold it through an agent in the states to Louis Friedlander and F. K. Houston of San Francisco (Marin County Recorder's Office 1912: 356).

It is unclear when efforts were undertaken to reclaim land in the APE, although early records indicate some reclamation measures were in place in the northwestern part of the study area by 1876 (Marin County Recorder's Office 1876a: 473). The western part of the expansion area does not appear to have been reclaimed until circa 1910–1914, when historic maps show levees, ditches, and a pump house were in place (U.S. Geological Survey 1914, 1916). It is uncertain whether Ferris or Friedlander and Houston were directly connected to these drainage improvements. Ferris was the least likely candidate considered responsible for these changes as he was living abroad at that time. Upon purchasing the property, it is probable that Friedlander and Houston rented the reclaimed land to sharecroppers who used it to grow oats and barley (Shannon 1992).

In 1916, California Fruit Canners received title to the property (known as Marin Meadow) and transferred it to California Packing Corporation (Calpak) (now Del Monte) (Marin County Recorder's Office 1917: 458–476). Calpak, a large fruit processing company formed in 1916 from a handful of canners and marketers (including California Fruit Canners), vastly improved irrigation and drainage in the study area to meets its large-scale operating needs. The company constructed additional levees, ditches, and onsite wells, built or improved roads, and put in place a handful of structures, including barns and residences. Over the next 30 years Calpak used the property to grow sugar beets, peas and other crops, as well as breed stallions that were used in the farm operations (Jones & Stokes 1998, Shannon 1992).

By 1948, Calpak sold the property to H. Ward Dawson. Within the next 20 years the southern part of the SLC parcel was reclaimed and used by Hamilton Air Force Base for an antenna field and firing range. Over time additional owners included McAlester Construction Finance and Bel Marin Keys Development Association. In 2001, the State of California purchased the land within the expansion area . Agricultural use of the property still occurs but is limited to dry farming of oat hay (Jones & Stokes 1998, Shannon 1992).

Summary of Known Cultural Resources in the APE

Based on the methods described above, 1 historic-period site and no prehistoric sites have been identified within the proposed expansion area. In addition, 14 architectural resources, 2 landscape features, and 1 linear resource were identified and evaluated as a result of the present study.

Historic Archaeology

The field survey resulted in the identification of 1 historic site. The site is comprised of a large concentration of historic debris and household items (Jones & Stokes 2002). There is no evidence of a foundation or remnants of a structure at the site location. The site is comprised of a concentration of materials

scattered between the outboard side of the modern levee and the high tide line on San Pablo Bay, several hundred yards south of the Pump House. It appears that the historic dump is an intrusive secondary deposit, and at high tide, the site is completely submerged. The historic materials appear to date to the 1920–40s. The site has been evaluated for eligibility for listing in both the NRHP and the CRHR (Jones & Stokes 2002). The site does not meet the criteria of significance for either the NRHP or the CRHR as described below under *Thresholds of Significance*.

Prehistoric Archaeology

For the purposes and scope of the proposed BMKV expansion, the issue of deeply buried early (5,000 years old and older) prehistoric sites was not pursued further because the proposed BMKV expansion area is not expected to require excavation into the bay-mud layer, and therefore it is unlikely to reach horizons where prehistoric resources may be found. In addition, the current setting of the expansion area does not allow for a subsurface investigation of this research issue. The expansion area is currently below the mean sea level, and the present water table would make it impossible to conduct any kind of trenching or auguring to any depth with meaningful results. No prehistoric resources were identified during the limited field survey conducted within the expansion area.

Historic Architecture and Structures

A brief description and evaluation of NRHP and CRHR eligibility for each architectural resource and landscape and linear feature is presented below.

Levee and Ditch System

A system of levees and ditches is located throughout the expansion area. The system lacks integrity, and for this reason, it does not appear to meet the criteria for listing in the NRHP or the CRHR .

Overflow Structure

An overflow structure is located in the northern part of the BMKV parcel. Lacking historical and architectural significance, the structure does not appear to meet the criteria for listing in the NRHP or the CRHR

Farm Complex

A house, barn, and shed sheltered by a Eucalyptus grove are located in the north central part the BMKV parcel. All 3 buildings lack historical and architectural significance. For these reasons, they do not appear to meet the criteria for listing in the NRHP or the CRHR. In addition, the Eucalyptus plantings do not appear to be eligible for listing because they do not appear to be historically significant.

Pump House

A pump house is located along the eastern boundary of the BMKV parcel, adjacent to San Pablo Bay. The pump house does not appear to meet the criteria for listing in the NRHP or the CRHR because it lacks historical and architectural significance.

Barn

A large barn is located in a Eucalyptus grove directly northeast of Pacheco Pond. The barn does not appear to meet the criteria for listing in the NRHP or the CRHR because it lacks historical and architectural significance. The Eucalyptus plantings do not appear to be eligible for listing because they do not appear to be historically significant.

(The features described below, the Air Force Antenna Complex, the Air Force Rifle Range, and the New Pump House, are part of the authorized HWRP. These areas are not part of the proposed BMKV expansion but are considered under the cultural resources analysis because of their close proximity to the proposed expansion site.)

Air Force Antenna Complex

The remnants of an Air Force antenna complex are located in the center of the SLC parcel. The complex includes an operations building, a generator building, and seven 50-foot-tall poles topped by antennas. Neither building appears to meet the criteria for listing in the NRHP or the CRHR because they do not appear to be historically or architecturally significant.

Air Force Rifle Range

A former rifle range (originally part of HAAF) is located in the southeast corner of the SLC parcel near San Pablo Bay. The range consists of a target range, an ammunitions building, an administration building, a shed, and a target practice

field. Lacking historical and architectural significance, these buildings do not appear to meet the criteria for listing in the NRHP or the CRHR.

New Pump House

A concrete pump house is located west of the firing range. The building does not appear on a 1981 map and most likely was constructed within the last 20 years (U.S. Geological Survey 1959). It does not appear to be eligible for listing in the NRHP or the CRHR because it does not meet the criteria of exceptional significance for recently constructed buildings.

Environmental Consequences and Mitigation Measures

Approach and Methods

In order to assess the impacts on cultural resources, several steps were taken to identify potentially significant prehistoric and historic resources within the proposed expansion area. Jones & Stokes cultural resources specialists conducted a records search of previously recorded archaeological and historic sites at the Northwest Information Center at Sonoma State University, conducted background and archival research, consulted the NAHC and members of the local Native American community, and conducted field surveys. Where historic resources were identified, they have been assessed for significance according to CRHR and NRHP in order to assess the level of impact upon the resources within the expansion area.

Impact Mechanisms

Ground-disturbing activities could adversely affect significant historic resources in the proposed BMKV expansion area. Ground-disturbing activities could also adversely affect previously unidentified prehistoric cultural resources in the proposed BMKV expansion area.

The proposed expansion may require the demolition or removal of existing buildings, structures, or linear and landscape features. Buildings, structures, and linear and landscape features over 50 years old have been identified and evaluated for historical significance. None of the resources evaluated appears to be historically or architecturally significant. No impact to historic architectural structures or features is anticipated.

Thresholds of Significance

Criteria for Determining Effects under CEQA

According to State CEQA guidelines, a project with an effect that may cause a substantial adverse change in the significance of a historic resource is a project that may have a significant effect on the environment (CEQA rev. 1998 Section 15064.5(b)). CEQA further states that a substantial adverse change in the significance of a resource means the physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of a historic resource would be materially impaired. Actions that would materially impair the significance of a historic resource are any actions that would demolish or adversely alter those physical characteristics of a historic resource that convey its historical significance and qualify it for inclusion in the CRHR or in a local register or survey that meet the requirements of sections 5020.1(k) and 5024.1(g) of the Public Resources Code.

Criteria for Determining Effects under Section 106

Under federal regulations, a project has an effect on a historic property when the undertaking could alter the characteristics of the property that may qualify the property for inclusion in the NRHP, including alteration of location, setting, or use. An undertaking may be considered to have an adverse effect on a historic property when the effect may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects on historic properties include, but are not limited to:

- physical destruction or alteration of all or part of the property;
- isolation of the property from or alteration of the property's setting when that character contributes to the property's qualifications for listing in the NRHP;
- introduction of visual, audible, or atmospheric elements that are out of character with the property or that alter its setting;
- neglect of a property resulting in its deterioration or destruction; or
- transfer, lease, or sale of the property (36 CFR 800.9).

Impacts and Mitigation Measures of No-Action Alternative

Under the No-Action Alternative, no cultural resources would be disturbed.

Impacts and Mitigation Measures Common to Alternatives 1–3

Impact CR-1: No Impact to Known Significant Architectural or Archaeological Resources

Based on archival research and field investigations, this alternative would not impact any known significant architectural or archaeological resources. The proposed BMKV expansion area does not appear to have a high potential for the discovery of archaeological resources.

Impact CR-2: Potential Impacts to Buried Cultural Deposits or Human Remains

Construction activity may encounter unexpected buried cultural deposits or human remains. This impact is considered significant. To reduce this impact to a less-than-significant level, the following mitigation measures would be implemented.

Mitigation Measure CR-1: Stop Work if Buried Cultural Deposits Are Encountered during Construction Activities.

If buried cultural resources, such as chipped stone or groundstone, historic debris, building foundations, or human bone, are inadvertently discovered during ground-disturbing activities, work will stop in that area and within a 100-foot radius of the find until a qualified archaeologist can assess the significance of the find.

Mitigation Measure CR-2: Stop Work if Human Remains are Encountered during Construction Activities.

If human skeletal remains are encountered, the county coroner will be contacted immediately. If the county coroner determines that the remains are Native American, the coroner will then be required to contact the NAHC (pursuant to Section7050.5 (c) of the California Health and Safety Code) and the County Coordinator of Indian Affairs. A qualified Jones & Stokes archaeologist will also be contacted immediately.

If any human remains are discovered in any location other than a dedicated cemetery, there will be no further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent human remains until:

- the county coroner has been informed and has determined that no investigation of the cause of death is required; and
- if the remains are of Native American origin,

- the descendants from the deceased Native Americans have made a recommendation to the landowner or the person responsible for the excavation work for means of treating or disposing of, with appropriate dignity, the human remains and any associated grave goods as provided in Public Resources Code Section 5097.98; or
- the NAHC was unable to identify a descendent or the descendent failed to make a recommendation within 24 hours after being notified by the commission.

According to the California Health and Safety Code, 6 or more human burials at 1 location constitute a cemetery (Section 8100), and disturbance of Native American cemeteries is a felony (Section 7052). Section 7050.5 requires that construction or excavation be stopped in the vicinity of discovered human remains until the coroner can determine whether the remains are those of a Native American. If the remains are determined to be Native American, the coroner must contact the NAHC.

Impacts and Mitigation Measures Unique to Alternative 1

Impact CR-3: Potential Cultural Resources Impacts Resulting from Construction of the Bay Trail, Alternative 1

The current boundaries of the Alternative 1 Bay Trail are outside of the area surveyed on the BMKV parcel. While the area near the proposed interpretive center and a portion of the proposed Bay Trail near HAAF is encompassed in the APE for the *Hamilton Air Force Airfield Disposal and Reuse Environmental Impact Statement* (Jones & Stokes 1996), the area would require additional study in order to make conclusions regarding impacts of the Alternative 1 trail route on cultural resources. While this area was included in the records search for the proposed BMKV wetland restoration, a current field survey would be required for both archaeological and architectural resources, as well as the completion of additional historical research concerning the specific area of impact. No statement regarding potential impacts to this alternative route can be made until further studies are conducted.

Aesthetics

Affected Environment

Data Sources

The evaluation of aesthetics is based on information contained in the *Bel Marin Keys Unit 5 Final Environmental Impact Report/Environmental Impact Statement* (Environmental Science Associates 1993), and information collected during a site visit conducted in March 2002.

Adjacent Land Uses

The BMKV site abuts San Pablo Bay along the site's entire eastern side. A portion of the site's northeastern side lies adjacent to Novato Creek. On its northwestern side, the site lies adjacent to the BMK housing development. On its southwestern side, the site borders the HAAF parcel. On its western side, the site borders Pacheco Pond.

Viewer Groups

The primary viewers of the expansion site are the occupants of the BMK residential homes that abut the edge of the BMKV parcel. Other viewers includes pedestrians and roadway travelers who use the public streets.

There are no designated public scenic vista points in the BMK residential area in close proximity to the south lagoon berm that separates the lagoon from BMKV.

Key Viewpoints

Five key viewpoints were established in order to assess impacts to aesthetic resources within the expansion area. Locations and directions of these viewpoints are identified in figure 4-12 and described below. The view from each of these viewpoints is also depicted in representative photographs shown in figure 4-13.

Viewpoint 1

Viewpoint 1 is located at the eastern end of Bel Marin Keys Boulevard, adjacent to the south lagoon lock structure. The view faces east towards San Pablo Bay. The viewshed primarily consists of the south lagoon in the foreground (including the boat lock), flat farmland and a utility tower in the middle ground, and isolated hills in the background. San Pablo Bay is a small portion of the background view from street level/ground floor but is prominent from the second-story level. The view of the bay is partially obstructed by the outboard levee.

Viewpoint 2

Viewpoint 2 is located south of Viewpoint 1, at the eastern end of Bahama Reef in the BMK residential area. The view faces east towards San Pablo Bay. The viewshed primarily consists of the south lagoon in the foreground and flat, vegetated land in the middle ground and background. Views from this viewpoint are clear and unobstructed by utilities or other physical structures. San Pablo Bay is a small portion of the background view from street level/ground floor but is prominent from the second-story level. The view of the bay is partially obstructed by the outboard levee.

Viewpoint 3

Viewpoint 3 is located southwest of Viewpoint 2, at the southeastern end of Del Oro Lagoon in the BMK residential area. The view faces southeast towards HAAF and San Pablo Bay. The viewshed primarily consists of the south lagoon in the foreground, flat farmland in the middle ground, and isolated trees (on the SLC parcel) and distant rolling hills in the background. Views from this viewpoint are clear and unobstructed by utilities or other physical structures. San Pablo Bay is a small portion of the background view from street level/ground floor but is prominent from the second-story level. The view of the bay is partially obstructed by the outboard levee.

Viewpoint 4

Viewpoint 4 is located southwest of Viewpoint 3, at the end of Dolphin Isle in the BMK residential area. The view faces southeast towards HAAF. The viewshed primarily consists of the south lagoon in the foreground, an isolated tree and old farmhouse structure in the middle ground, and distant views of flat farmland and rolling hills in the background. Views from this viewpoint are non-contiguous. San Pablo Bay is barely visible from street level/ground floor but is prominent from the second-story level. The view of the bay is partially obstructed by the outboard levee.

Viewpoint 5

Viewpoint 5 is located west of Viewpoint 4, at the south end of Caribe Isle in the BMK residential area. The view faces south towards HAAF. The viewshed primarily consists of the south lagoon in the foreground and middle ground, and distant views of flat farmland, rolling hills, and utility structures in the background. Views from this viewpoint are unobstructed.

Environmental Consequences and Mitigation Measures

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

Approach and Methodology

The impacts of the restoration alternatives were evaluated by analyzing the change in the visual character of the BMKV site and the change in views of the site from adjacent public areas and private areas within the BMK residential area.

The existing visual character was identified by visiting the site and taking photographs from key vantage points (see figure 4-13 above). The future visual character is based on the designs identified in chapter 3.

Visual lines of site were determined by using 2 elevations at the key viewpoints to represent street-level/ground-floor views (13 feet NGVD—7 feet for street level + 1.5 feet for foundation + 4.5 feet to viewer height) and second-story views (23 feet NGVD—ground floor + 10 feet) from the ends of southward-facing streets. Elevations of the existing site were identified from prior levee and topographic surveys. Elevations of the future site with implementation of the restoration alternatives were based on the conceptual designs described in chapter 3.

The change in views resulting from building new or improved levees was identified by graphing the line of site from the key viewpoints to features within the restoration site affected by construction of the different alternatives. Examples of the profiles generated for several of the key viewpoints are included in appendix F.

Impact Mechanisms

The restoration alternatives include changing the existing aesthetic character of the BMKV site from predominantly agricultural to a mosaic of grassland, seasonal wetland, and tidal marsh. This would represent a change in the character of the views from adjacent areas.

The restoration alternatives also include the construction of new levees and improvement of existing levees and berms. These new and improved levees may alter or obstruct existing views of the restoration site.

Thresholds of Significance

The following significance criteria were used to evaluate the proposed BMKV expansion. Regarding aesthetics, the proposed expansion was identified as resulting in a significant impact on the environment if it would

- substantially degrade the aesthetic character of BMKV from adjacent viewpoints; or
- substantially obstruct existing unobstructed views of the BMKV site or of San Pablo Bay from public viewing locations or a substantial number of adjacent residences.

Impacts and Mitigation Measures of the No-Action Alternative

Under the No-Action Alternative, no wetland restoration would occur, and the expansion site would remain in its present condition. No change in the current views would be anticipated, and no mitigation measures would be required.

Impacts and Mitigation Measures Common to Alternatives 1–3

Impact AE-1: Change in Aesthetic Character of BMKV Site

The existing views from certain public streets and private residences that face directly onto the BMK south lagoon adjacent to BMKV include views of the BMKV site itself. The restoration alternatives would replace the existing agricultural fields, which dominate the existing view, with grassland, seasonal wetlands, and tidal marsh. While this represents a change in the aesthetic

character of the BMKV site, the proposed restoration, particularly the tidal marsh area, represents a return of the site to an approximation of the habitats and views that were present prior to agricultural development. Individual viewers may have subjective preferences for agriculture or for open space and habitat. However, the aesthetic character of the BMKV site with implementation of the project is expected to be generally perceived of as attractive and positive and aesthetically equivalent overall to the existing agricultural character of the site. Thus, while restoration would change the aesthetic character of the site, the restoration alternatives are not expected to substantially degrade the aesthetic character of the BMKV site and or the aesthetic character of existing views of the BMKV site. The potential for obstruction of views is discussed separately below.

Impacts and Mitigation Measures Unique to Alternatives 1 and 2

Impact AE-2: Obstruction of Existing Unobstructed Views of BMKV Site and San Pablo Bay, Alternatives 1 and 2

The existing views from certain public streets and private residences that face directly onto the BMK south lagoon adjacent to BMKV include views of the south lagoon, the agricultural fields at BMKV, and, from elevated viewpoints, San Pablo Bay in the background.

From the street level and ground floors in the residential area, the viewshed is characterized by the BMK south lagoon in the foreground and agricultural fields on the BMKV parcel (and its associated natural habitats) in the middle ground and background. San Pablo Bay is visible in the far background from the street level/ground floor, but it is a small portion of the background because of the distance to the bay and the presence of the existing outboard levee. Views from the second-story level are similar to ground-floor views but are substantially less obstructed by existing levees, and San Pablo Bay is a distinct part of the background.

Under Alternatives 1 and 2, a new levee would be built approximately 1,000 feet east and south of the south lagoon levee, at an initial elevation of approximately 12 feet NGVD, which includes a 4-foot allowance for settlement, resulting in a final elevation of 8 feet NGVD. In addition, the existing south lagoon berm, which presently varies between 2 and 5 feet NGVD, would be improved to an initial elevation of approximately 10 feet, which includes a 4-foot allowance for settlement, resulting in a final elevation of 6 feet NGVD.

The height of the new and improved levees would change a portion of the existing views from the street level/ground floor. The upland transition zone/swale area would be visible from the street level/ground floor. This view would be similar to the existing views of the nearest portions of BMKV. In the

middle ground, the street-level/ground-floor view of the tidal marsh restoration area would be obstructed by the new levee. In the background, the street level ground floor view of San Pablo Bay would be obstructed by the new levee. No change would occur to street-level/ground-floor views of the BMK south lagoon.

For second-story views, the lagoon, swale area, eastern part of the tidal marsh restoration area, and San Pablo Bay would be still be viewable, but a portion of the middle-ground view of the restoration area would be obstructed by the new levee. The view of the San Pablo Bay would be similar to the existing view and may be slightly improved by elimination of the outboard levee.

Under Bay Trail Spur Options 1A or 2A, a spur trail would provide public views of the restoration site and San Pablo Bay from the central levee. Under Alternatives 1 and 2, views would also be available from portions of the Bay Trail itself.

The new levee would obstruct portions of existing views from street level/ground floor for southward-facing homes in the southern part of the BMK residential area, but it would have a limited effect on second-story views. While unobstructed views would be available from the Bay Trail and from the optional spur trail, if built, the partial obstruction of street level/ground floor views is considered a significant impact.

The primary determinant of change in views is the height of the new levee, which is designed to protect BMK south lagoon and residential area from tidal flows introduced into the BMKV site. Since the levee height is designed for flood protection, lowering the levee is not considered feasible. This impact is therefore considered significant and unavoidable.

Impacts and Mitigation Measures Unique to Alternative 3

Impact AE-3: Obstruction of Existing Unobstructed Views of BMKV Site and San Pablo Bay, Alternative 3

Under Alternatives 3, a new levee would be built approximately 50 feet east and south of the eastern portion of the south lagoon levee, at an initial elevation of approximately 12 feet NGVD, which includes a 4-foot allowance for settlement, resulting in a final elevation of 8 feet NGVD. In addition, the western portion of the existing south lagoon berm, which varies between 2 and 5 feet in elevation, would be improved to an initial elevation of 10 feet NGVD, which includes a 4-foot settlement allowance, resulting in a final elevation of 6 feet NGVD. The height of the new and improved levees would change a portion of the existing views from street level/ground floor and could affect views from second stories of private residences.

From street level/ground floor, the proximity of the new levee to the viewpoints would obstruct all views of the BMKV site and San Pablo Bay under this alternative. For street-level/ground-floor views, this impact would be more severe than the obstruction described above for Alternatives 1 and 2. From second stories, the BMKV site and San Pablo Bay would still dominate the views and would not be substantially obstructed.

Under Spur Option 3A, a spur trail along the new levee would provide unobstructed views of the restoration site and San Pablo Bay. Unobstructed views would also be available along portions of the Bay Trail itself.

The new levee would obstruct existing views from street level/ground floor for southward-facing homes in the southern part of the BMK residential area. Although unobstructed views would be available from the Bay Trail and from the optional spur trail, if built, this is considered a significant impact.

The primary determinant of change in views is the height of the new levee, which is designed to protect BMK south lagoon and residential area from tidal flows introduced into the BMKV site. Since the levee height is designed for flood protection, lowering the levee is not considered feasible. The only mitigation available to reduce this impact would be to move the levee further away from the BMK south lagoon, as under Alternative 1 and 2. However, even this movement is not likely to completely avoid obstruction of some views, particularly from street level/ground floors. This impact is therefore considered significant and unavoidable.