3.3 Water Quality and Sediment

This section of the Final Environmental Impact Statement/Report (referred to throughout as the Final EIS/R) describes the existing water quality within the Phase 2 project area and analyzes whether implementation of the project would cause a substantial adverse effect on water quality. Given that many of the water quality constituents of concern are found in and exchange with sediment, sediment distribution and composition is described here as well. The information presented is based on a review of existing water and sediment quality within the area, and other pertinent federal, state, and local regulations, which are presented in Section 3.3.2, Regulatory Setting. Section 3.3.1, Physical Setting, is included to establish the origin and environmental context of the resources. Using this information as context, an analysis of the water-quality-related environmental impacts of the project is presented for each alternative in Section 3.3.3, Environmental Impacts and Mitigation Measures. The program-level mitigation measures described in Chapter 2, Alternatives, would be implemented as part of the project. Therefore, this section only includes additional, project-level mitigation measures as needed.

3.3.1 Physical Setting

Methodology

The development of the baseline conditions, significance criteria, and impact analysis in this section is commensurate to and reliant on the analysis conducted in the 2007 South Bay Salt Pond (SBSP) Restoration Project EIS/R (2007 EIS/R), which was both a programmatic EIS/R and a Phase 1 EIS/R. Information regarding water quality in the regional and Phase 2 project setting was primarily based on data collected by the San Francisco Estuary Institute (SFEI) Regional Monitoring Program (RMP), the U.S. Fish and Wildlife Service (USFWS), and the U.S. Geological Survey (USGS) and sampling conducted as part of the SBSP Restoration Project's Initial Stewardship Program (ISP) or Phase 1 actions, Adaptive Management Plan (AMP) special studies, and other special studies from the SBSP Restoration Project and the Santa Clara Valley Water District (SCVWD).

Regional Setting

Surface Water and Sediment Quality

The former salt ponds are at the interface between the urban environment and San Francisco Bay (Bay). The regional setting includes the South Bay itself, the SBSP Restoration Project pond complexes, and upland watershed areas. Water quality conditions for mercury, persistent organic constituents, other metals, and general water quality conditions (e.g., nutrients and dissolved oxygen) are discussed in this section. Regional water and sediment quality are also discussed in comparison to water and sediment quality guidelines, criteria, and objectives established by the Regional Water Quality Control Board, San Francisco Bay Region (SFRWQCB).

Mercury. Mercury occurs naturally in the Bay environment and has been introduced as a contaminant in various chemical forms from a variety of anthropogenic sources. Ambient levels of sediments in the Bay are elevated in total mercury above naturally occurring background levels. Although mercury often resides in forms that are not hazardous, it can be transformed through natural processes into toxic methylmercury.

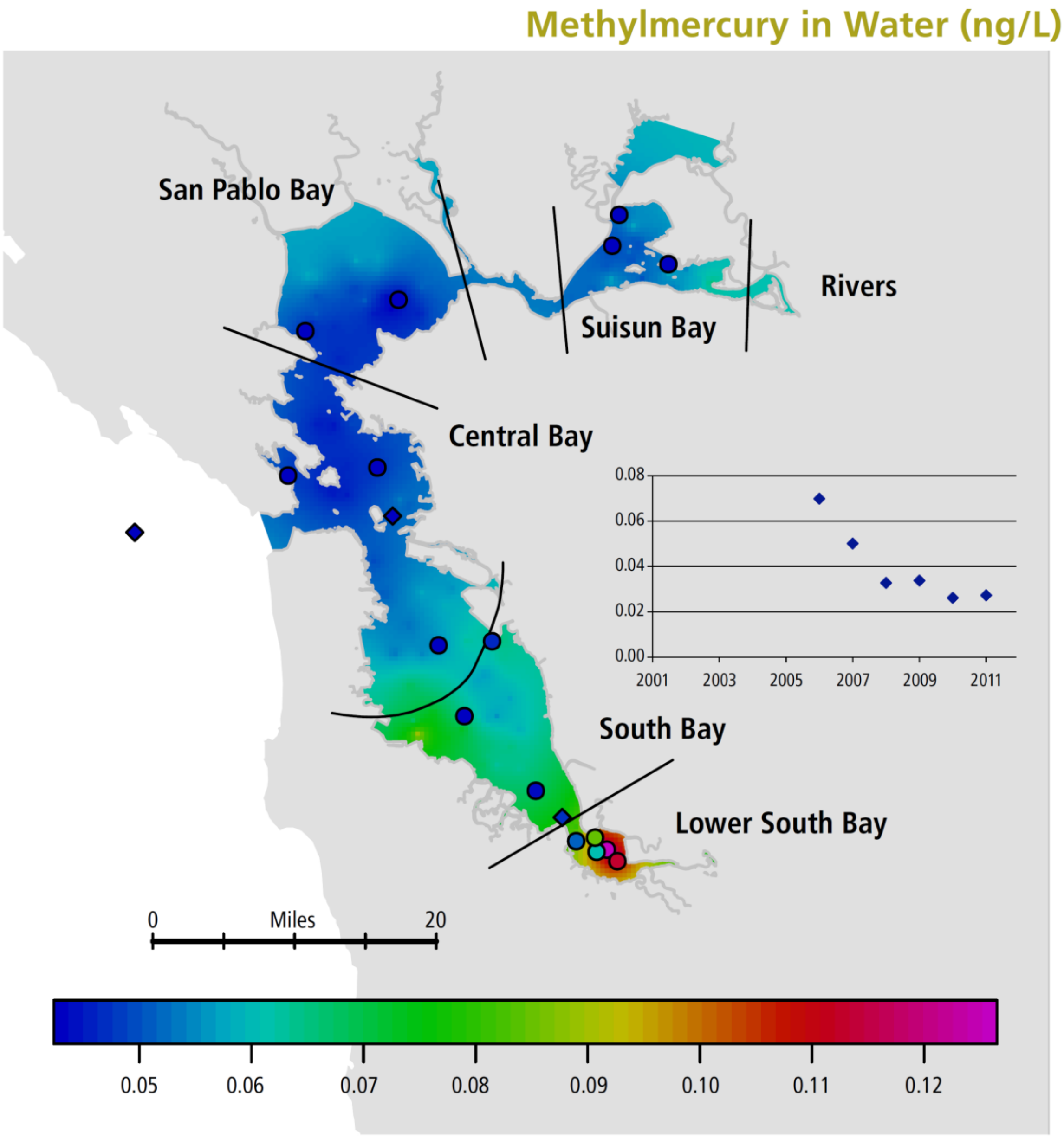
The primary concern with mercury contamination in the Bay is the accumulation of methylmercury in organisms, particularly at the top of aquatic food webs. Methylmercury typically represents only about 1 percent of the total of all forms of mercury in water or sediment, but it is the form that is readily accumulated in the food web and poses a toxicological threat to exposed species (SFEI 2012). Elevated methylmercury levels in fish can result in mercury exposure in humans who consume contaminated fish. Elevated levels of methylmercury can also adversely affect the health and fitness of fish and birds.

Methylmercury is produced in aquatic ecosystems through the methylation of inorganic mercury by microorganisms. Methylmercury has a complex cycle, influenced by many processes that vary in space and time. The rate of methylation is a function of an array of variables, including mercury levels, mercury speciation, oxidation reduction potential, microbial activity, sulfate levels, salinity, pH, dissolved oxygen, dissolved organic carbon, turbidity, solar radiation, and vegetation type. Although the interaction of these variables is not fully understood, wetlands are known to be significant sites of microbial methylation and potentially important sources of methylmercury to aquatic food webs (Benoit et al. 2003; Wiener et al. 2003). Natural accretion processes in salt marshes continually supply fresh layers of mercury-contaminated sediments, which can release mercury in a form that can become biologically available to mercury-methylating bacteria and subsequently bioaccumulate in the food chain. Because of the complex interactions between biological/physical processes, it is difficult to predict mercury concentrations in fish or other aquatic organisms, or birds, and water or sediment mercury concentrations.

Methylmercury and mercury concentrations in surface waters and sediment of the South Bay and the SBSP Restoration Project area have been evaluated by regional monitoring activities in the Bay (e.g., RMP) and by studies prepared for the SBSP Restoration Project. The South Bay and the lower South Bay have higher-than-average long-term methylmercury water concentrations when compared to other sections of the Bay (see Figure 3.3-1). For example, methylmercury concentrations in bay water during 2002 to 2011 averaged 0.11 nanogram per liter (ng/L) for the lower South Bay and 0.06 ng/L for the portion of the South Bay north of the Dumbarton Bridge. These water concentrations can be compared to a Bay-wide average of 0.04 ng/L (SFEI 2012). Average total mercury concentrations were also higher in the lower South Bay than in the rest of the Bay during 2002 to 2011 (18 ng/L in the lower South Bay as compared to 9 ng/L elsewhere), but mercury concentrations in the South Bay north of the Dumbarton Bridge were similar to Bay-wide average concentrations (9 ng/L). No regulatory guidelines exist for methylmercury concentrations in surface water—regulatory guidelines for methylmercury target fish tissue concentrations.

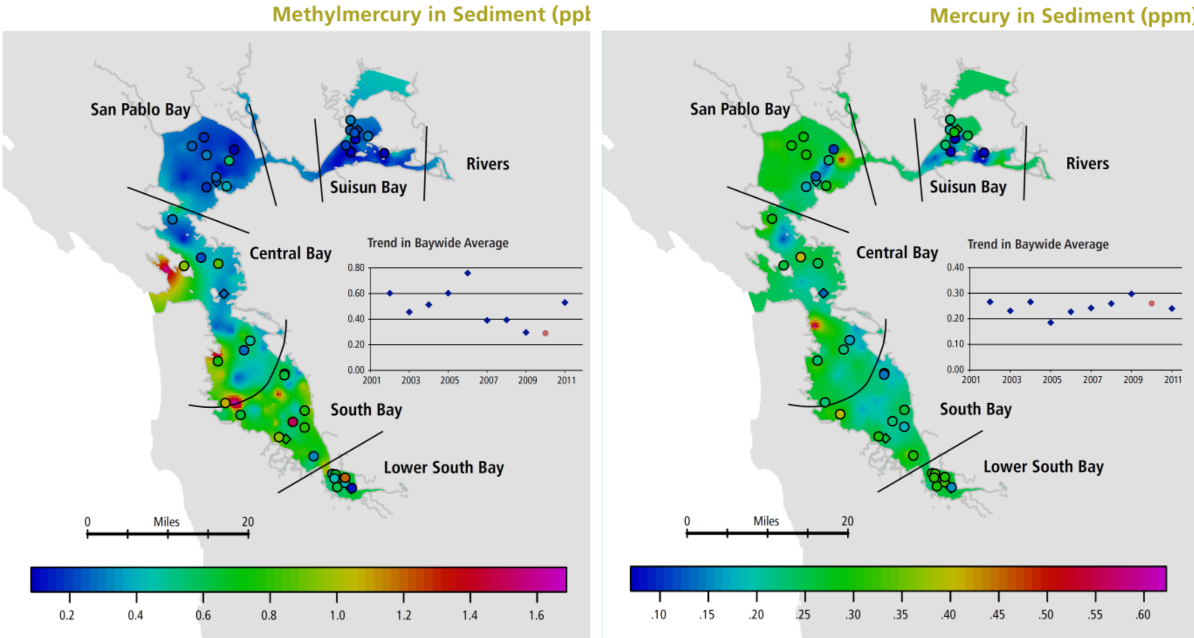
Methylmercury concentrations in sediment (2002 to 2011) averaged 0.72 microgram per kilogram (µg/kg) or part per billion (ppb) in the South Bay and 0.68 ppb in the lower South Bay, as compared to a Bay-wide average of 0.50 ppb. These concentrations indicate that long-term average sediment concentrations of methylmercury in the South Bay and lower South Bay are higher than Bay-wide averages. In contrast to methylmercury, the long-term average total mercury concentrations in sediment are similar in the lower South Bay and slightly lower (though perhaps not statistically significantly so) in the South Bay relative to other parts of the Bay (see Figure 3.3-2). Total mercury concentrations in sediment (2002 to 2011) averaged 0.26 milligram per kilogram (mg/kg) or part per million (ppm) in the lower South Bay and 0.22 ppm in the South Bay north of Dumbarton Bridge, and Bay-wide mercury concentrations averaged 0.25 ppm. Bay-wide average concentrations of total mercury in sediment have shown relatively little variability over this period (SFEI 2012). These concentrations provide an example of the lack of correlation between total mercury and methylmercury concentrations in sediment. No regulatory standards exist for methylmercury or mercury concentrations in sediment.

Figure 3.3-1. Regional Methylmercury Concentrations in Surface Water



Source: 2012 Regional Monitoring Program Update, SFEI 2012

Figure 3.3-2. Regional Mercury and Methylmercury Concentrations in Sediment



Source: 2012 Regional Monitoring Program Update, SFEI 2012

Sediment samples collected in South Bay salt ponds typically contained total mercury concentrations either similar to or slightly greater than ambient mercury concentrations in the Bay (Brown and Caldwell et al. 2005), with the exception of some ponds in the Alviso pond complex. Sediments in ponds near Alviso Slough have considerably higher mercury concentrations than Bay sediments (i.e., about 2 to 10 times the ambient Bay concentration) (Marvin-DiPasquale and Cox 2007). These higher concentrations are due to the mercury load that historically entered the lower South Bay from the Guadalupe River watershed, which contains the largest inactive mercury mining district in the United States (SFRWQCB 2008).

Organic Chemicals. Bioaccumulative pollutants such as polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and legacy organochlorine pesticides are of general concern in the Bay because concentrations in fish often exceed human-health-based criteria for fish consumption. PCBs are a class of organic chemicals that do not break down quickly in the natural environment and have been found to pose bioaccumulation risks. PCB data for the South Bay consistently exceeded human-health-based criteria for fish consumption (0.17 ng/L), but rarely exceeded saltwater aquatic-life-based criteria (30 ng/L). Average PCB concentrations in Bay sediment are higher in the Central and South Bay than in North Bay areas (Figure 3.3-3). The lower South Bay and the South Bay north of the Dumbarton Bridge have long-term (2002 to 2011) PCB concentrations greater then Bay-wide averages (10.7 ppb and 8.6 ppb, respectively, as compared to 7.2 ppb). Models suggest that sediment PCB concentrations must decline to about 1 ppb for concentrations in sport fish to fall below the threshold of concern for human health (SFEI 2012).

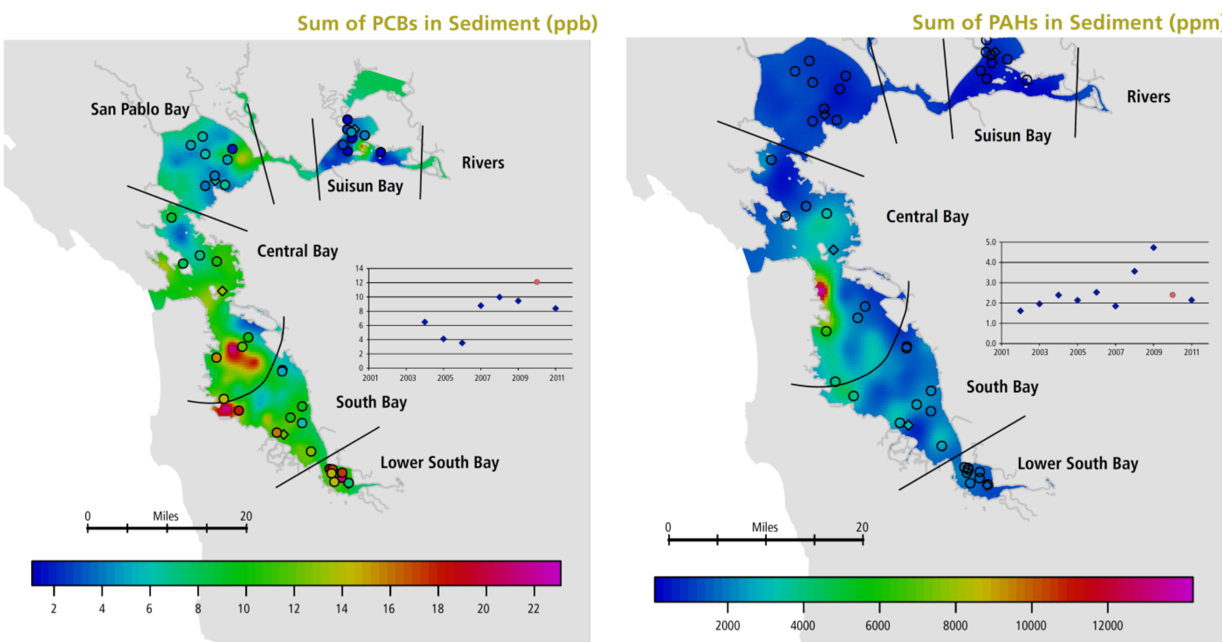
PAHs are known to be environmentally persistent and pose a concern for bioaccumulation. PAH data for the South Bay exceeded human-health-based criteria for fish consumption (8.8 ng/L), but are below the saltwater aquatic-life-based criteria. The Central Bay has had the highest average PAH sediment concentration (4.0 ppm) of any Bay segment. The South Bay (2.4 ppm) and lower South Bay (1.9 ppm) had PAH concentrations less than the Bay-wide long-term average of 2.6 ppm (SFEI 2012) (Figure 3.3-3).

Organochlorine pesticides (including chlordanes and dichloro-diphenyl-trichloroethanes [DDTs]) are also environmentally persistent and pose a concern for bioaccumulation. Chlordane and DDT concentrations in South Bay surface waters typically exceed human-health-based criteria. Chlordanes in South Bay sediments are often greater than ambient values (1.1 ppb) and sediment DDTs are similar to or greater than ambient values (7.0 ppb).

Within the SBSP Restoration Project area, sediments contained either non-detectable concentrations of organic constituents or concentrations below ambient values during ISP sampling events (USFWS and CDFG 2003). (The ISP sampling of the SBSPs focused primarily on the Alviso pond complex, and only a limited number of samples were collected in both the Eden Landing and the Ravenswood pond complexes.)

Other Metals. Metals can be persistent inorganic chemicals that are present in the environment due to both natural conditions and anthropogenic influences. Depending on the chemical nature of the metal, ecological risks could result from concentrations elevated above toxic thresholds or bioaccumulation levels.

Figure 3.3-3. Regional PCB and PAH Concentrations in Sediment



Source: 2012 Regional Monitoring Program Update, SFEI 2012

Copper and nickel are of particular concern for the Bay because ambient concentrations of dissolved copper and dissolved nickel can approach Basin Plan water quality objectives (6.9 micrograms per liter [µg/L] and 11.9 µg/L, respectively). The long-term average for dissolved copper is 3.2 µg/L in the lower South Bay and 2.4 µg/L in the South Bay north of the Dumbarton Bridge, which is greater than the Bay-wide average (1.9 µg/L). The long-term average for dissolved nickel is 3.0 µg/L in the lower South Bay and 2.1 µg/L in the South Bay north of the Dumbarton Bridge, which is greater than or equal to the Bay-wide average concentration (2.1 µg/L).[1]

Metals tested in SBSP Restoration Project waters include arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc; in general, metal concentrations were low. However, dissolved nickel concentrations often exceed the water quality objectives and dissolved lead and dissolved arsenic concentrations have also exceeded their water quality objectives in at least one pond (Brown and Caldwell et al. 2005).

The concentrations in sediment of metals, including arsenic, cadmium, chromium, copper, lead, nickel, selenium, silver and zinc, were evaluated for data collected in the South Bay and the SBSP Restoration area. In general, these metals were detected at concentrations similar to their respective SFRWQCB ambient criteria. Within the SBSP Restoration Project area, the spatial distribution of the detected metal concentrations suggests that there is not a localized metals impact. Also, the sediment data reviewed for the Alviso pond complex indicate metal concentrations similar to those within the surrounding watershed (USFWS and CDFG 2003).

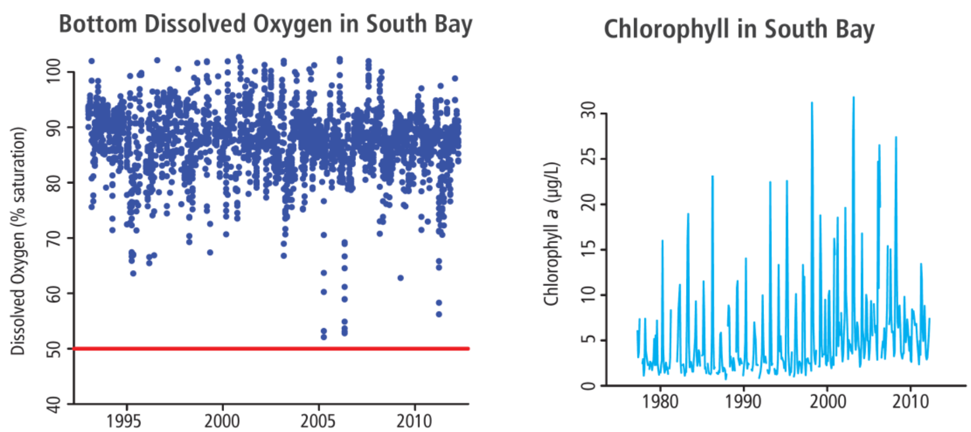
General Water Quality Conditions. Salinity in the South Bay below the Dumbarton Bridge varies with the daily tides and is typically near seawater levels at 28 to 33 parts per thousand (ppt), because the South Bay receives relatively little freshwater inflow except during the wet season, when local stream discharges can cause salinity to decrease to 20 ppt or lower (Schemel et al. 2003; USFWS and CDFG 2003). For more information regarding how hydrodynamics can affect salinity, see Section 3.2, Hydrology, Flood Management, and Infrastructure. Historical salinity concentrations in the salt ponds varied considerably, ranging from as low as the Bay concentration to brines with salinity concentrations several times that of the Bay. More recently, many of the ponds have been operated for limited circulation.

In sloughs and ponds, dissolved oxygen concentrations regularly fluctuate on a daily cycle. Algal growth in salt ponds can cause dissolved oxygen and pH levels to vary significantly over the course of a day. These levels vary because during daylight hours, photosynthesis produces oxygen and consumes dissolved carbon dioxide. At night, respiration produces dissolved carbon dioxide and consumes oxygen. Therefore, any significant algal growth causes dissolved oxygen and pH levels to peak during the late afternoon and to be at their lowest levels before dawn. Diurnal and/or tidal cycling can also influence salinity, pH, temperature, and dissolved oxygen levels.

Diurnal and/or tidal cycling is particularly important for dissolved oxygen, which is influenced by both circulation and respiration of algae. Minimum dissolved oxygen levels in the South Bay as a function of percent saturation (typically recorded at or near the bottom of the water column) and chlorophyll-a concentrations for the South Bay, averaged over the top 10 feet (3 meters) of depth, are shown on Figure 3.3-4a (SFEI 2012). Although dissolved oxygen concentrations in open waters are generally above water quality objectives, sloughs in the South Bay often do not meet the Basin Plan objective of 5.0 milligrams per liter (mg/L).

[1] Bay-wide average taken from SFEI: http://www.sfei.org/data.

Figure 3.3-4a. Dissolved Oxygen and Chlorophyll-a in the South Bay



Source: 2012 Regional Monitoring Program Update, SFEI 2012

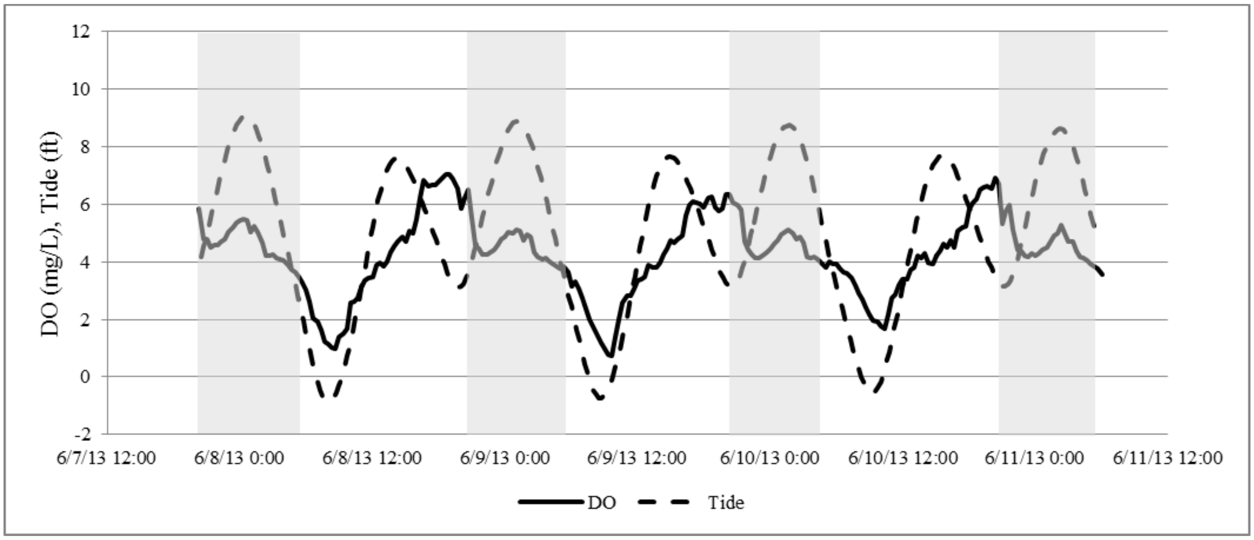
Dissolved oxygen concentrations within former salt ponds have shown significant variations throughout the day. DO levels in shallow salt marshes typically reach their minimum and maximum within 2 hours of sunrise and sunset, respectively. Under ideal conditions, photosynthesis generates DO faster than the system can consume it. The resulting DO surplus becomes depleted as respiration continues through the night (Tyler, Brady et al. 2009). Whether or not the surplus that has accumulated throughout the day is sufficient to prevent a hypoxic event depends on a number of factors, the most influential of which being water temperature and daily solar input (Tyler, Brady et al. 2009). Several researchers have linked hypoxic events to relatively high water temperatures during warmer months (Tyler, Brady et al. 2009). Continuous monitoring of DO in a representative pond in the South Bay was conducted as a part of the AMP. The data show low DO in the late AM when the tide is also low or outgoing (Figure 3.3-4b).

There have been reported occasions when a severe depletion in dissolved oxygen levels in the Alviso pond complex has led to gulls feeding on oxygen-stressed fish or conditions when low dissolved oxygen levels caused fish mortality within the former salt ponds (SFRWQCB 2008).

Continuous monitoring data from within former salt ponds show that pH levels can vary significantly and are often above the Basin Plan objective of 8.5. However, receiving water data have also shown that high pH levels from pond discharges are quickly normalized in nearby sloughs and the Bay (SFRWQCB 2008).

Due to shallow water depths and limited tidal exchange, water temperature in the salt ponds is elevated and varies widely throughout the day. Annual water temperatures within the ponds generally range from 40 to 80 degrees Fahrenheit and generally track air temperature (SFRWQCB 2008).

Figure 3.3-4b. 80-hour plot of DO and Tide Height in pond A21, 6/7/13 to 6/11/13 Spring tide, new moon.



Source: Dissolved Oxygen Levels and Frequent Hypoxia Associated with Restored Tidal Ponds in South San Francisco Bay, La Luz, et, al, 2015, Draft.

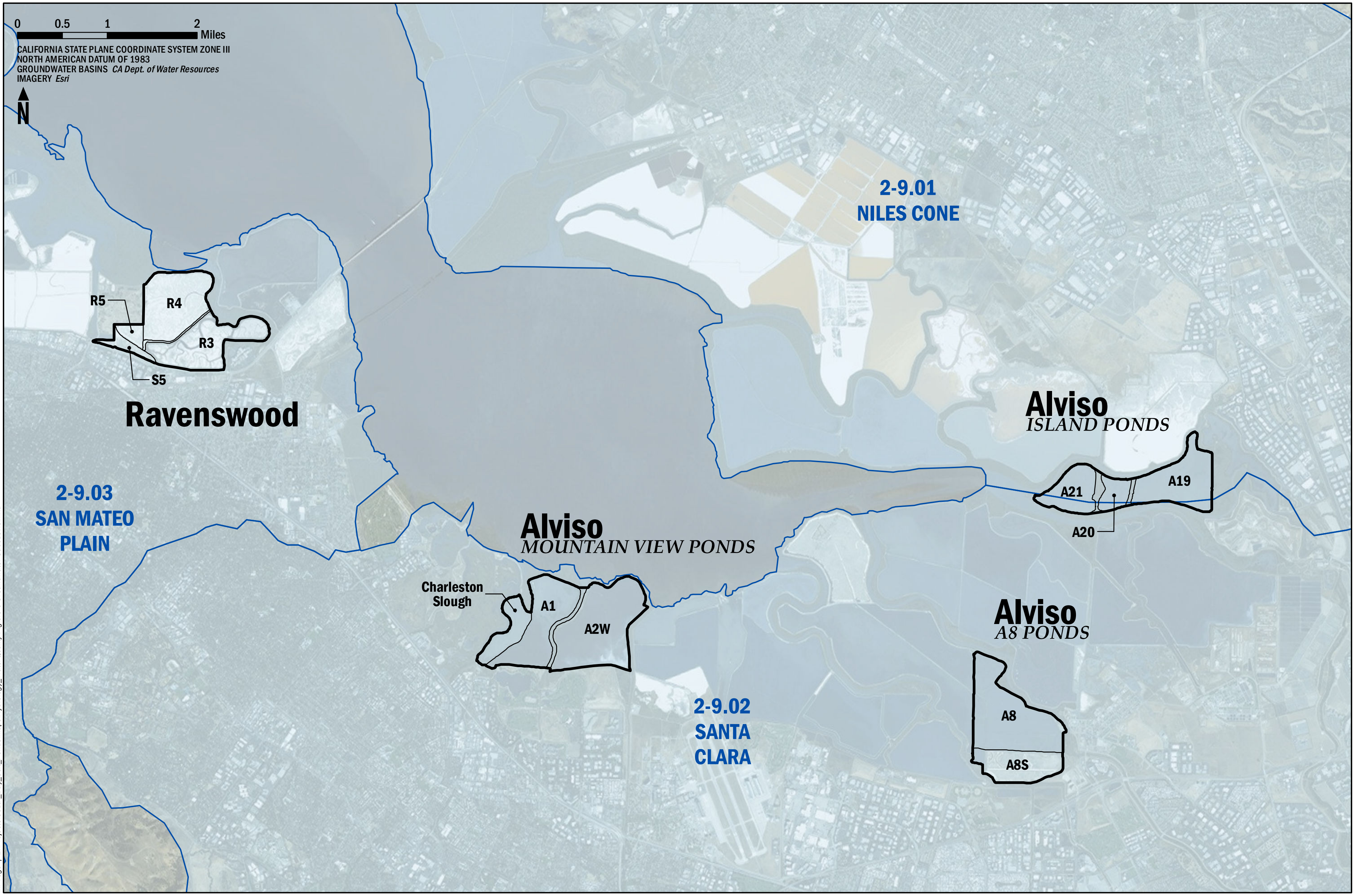
Groundwater

This section characterizes the existing physical setting of the South Bay with respect to groundwater. Groundwater can be affected by surface water conditions through surface water/groundwater interactions.

The Santa Clara Valley Groundwater Basin is in the South Bay (DWR 2003). Within this basin, the groundwater subbasins include the Niles Cone, Santa Clara, and San Mateo Plain Subbasins (see Figure 3.3-5). The Alviso pond complex is primarily within the Santa Clara Subbasin, but northeastern ponds are within the Niles Cone Subbasin. The Ravenswood pond complex is within the San Mateo Plain Subbasin.

Historically, groundwater was the major source of water supply for Santa Clara County. Currently the groundwater basin in Santa Clara County is actively managed by the SCVWD, which recharges between 100,000 and 130,000 acre-feet of water per year in a non-drought year. Groundwater extraction is important to the salt ponds because historical over-pumping led to land subsidence. Consequently the bottoms of the ponds have been lowered and need even more sediment accretion to reach marsh plain elevation where marsh plants will thrive.

Local land elevations, particularly in the South Bay, have subsided from their original elevations before historical development, primarily due to the extraction of significant amounts of groundwater. Land subsidence in the South Bay is largely due to agricultural pumping in the early part of the 1900s. Land adjacent to the Bay in Santa Clara Valley was reported to have subsided 2 to 8 feet from 1912 to 1967 (Helley et al. 1979), and up to 13 feet locally (SFRWQCB et al. 2003).



M. Voge | L:\Projects\South_Bay_Salt_Ponds\Maps\Hydrology_WaterQuality\Fig 3.3-5 Groundwater Subbasins.mxd

Groundwater Subbasin
Project Area

Figure 3.3-5
Groundwater Subbasins

Subsidence was virtually halted by 1971, when groundwater pumping decreased with surface water importation from the State Water Project.[2] Nevertheless, ponds in the Alviso pond complex are subsided due to historic groundwater pumping. In the fourth year of this historic drought (2012-2015), land subsidence is an issue of concern for water management agencies.

Groundwater levels have previously been depleted by withdrawing groundwater at rates faster than it recharges naturally. But groundwater levels have been restored in the past 40 years by regional groundwater management actions, particularly those by the SCVWD. Today, groundwater flow is generally bayward, providing a measure of protection from salinity intrusion (DWR 2003). Groundwater levels for wells within or near the Alviso pond complex indicate that after groundwater levels declined to as much as 100 feet below mean sea-level in the 1960s, water levels recovered due to imported State Water Project surface water. More recent data indicate that shallow wells near the salt ponds have water levels at or near sea level, as would be expected for an aquifer in hydraulic communication with the Bay. Groundwater levels for wells in the Ravenswood pond complex of the San Mateo Subbasin indicate that the horizontal groundwater gradient is eastward toward the Bay (Fio and Leighton 1995), but pumping in some areas west of U.S. Highway 101 (U.S. 101) has drawn water levels below mean sea-level, creating a downward vertical gradient.

Virtually all of the salt ponds are underlain by Holocene bay mud. The bay mud is relatively impermeable to both infiltration and groundwater flow. Bay mud extends to the edge of the Alviso pond complex, and the depths around the edges of the Alviso pond complex range from surface level to as deep as approximately 22 feet below mean sea level (msl) (Tudor Engineering Company 1973). For example, the thickness of bay mud along Alviso Slough and up into the Guadalupe River ranges from approximately 5 to 25 feet below msl, with alluvium overlying some of these areas. Also, the depth of bay mud along Coyote Creek ranges from approximately 2 to 22 feet below sea level, and young alluvium overlies the mud in the upper reaches of Coyote Creek. Other SBSP areas exhibit similar bay mud distribution and thicknesses.

Groundwater Aquifers. Groundwater aquifers in the South Bay include shallow aquifers connected to the Bay and deeper aquifers that are generally isolated from shallow aquifers. An exception to this isolation occurs in the vicinity of Coyote Creek, where the confining layer over the deep aquifer is leaky. The deep aquifers beneath most of the Santa Clara Valley Groundwater Basin are separated from the Bay and shallow ground aquifers (above approximately 100 feet deep) by a combination of bay mud and alluvial layers, which together act as a natural confining layer. This confining layer occupies the northern portion of the Santa Clara Subbasin (at an average depth of 100 to 200 feet) and extends northward beneath the Bay and along its margins on both the east and west sides. This confining layer provides protection from infiltration of saltwater or contaminated groundwater into the deeper water supply aquifers.

Upland areas serve as recharge areas for the Santa Clara Valley Groundwater Basin, where precipitation infiltrates into the soil and percolates to the groundwater table before flowing downgradient toward the natural discharge points at the margins of and beneath the Bay. Under natural conditions before historical development, precipitation and recharge in upland areas and discharge in surface springs and beneath the

[2] SCVWD has a contract for 100,000 acre-feet per year of water from the State Water Project, delivered via the Harvey O. Banks Pumping Plant in the southern delta and the South Bay Aqueduct.

Bay was sufficient to prevent the infiltration of surface water from the Bay (DWR 2003). It is when these natural conditions were altered by groundwater extraction that historical saltwater intrusion occurred.[3]

Groundwater levels have previously been depleted by overpumping, but groundwater levels have been restored within the past 40 years by regional groundwater management actions, including those by the SCVWD. Today, flow is generally bayward, providing a measure of protection from salinity intrusion (DWR 2003). Groundwater levels for wells within or near the Alviso pond complex indicate that after groundwater levels declined to as much as 100 feet below msl in the 1960s, water levels recovered due to imported State Water Project surface water. More recent data indicate that shallow wells in and near the salt ponds have water levels at or near sea level, as would be expected for an aquifer in hydraulic communication with the Bay. Groundwater levels for wells in the Ravenswood pond complex of the San Mateo Subbasin indicate that the horizontal groundwater gradient is eastward toward the Bay (Fio and Leighton 1995), but pumping in some areas west of U.S. Highway 101 (U.S. 101) has drawn water levels below msl, creating a downward vertical gradient.

Local land elevations, particularly in the South Bay, have subsided from their original elevations before historical development, primarily due to the extraction of significant amounts of groundwater. Land subsidence in the South Bay is largely due to agricultural pumping in the early part of the 1900s. Land adjacent to the Bay in Santa Clara Valley was reported to have subsided 2 to 8 feet from 1912 to 1967 (Helley et al. 1979), and up to 13 feet locally (SFRWQCB et al. 2003). Subsidence was virtually halted by 1971, when groundwater pumping decreased with surface water importation from the State Water Project.[4] Nevertheless, ponds in the Alviso pond complex are subsided due to historic groundwater pumping.

Groundwater Quality. Groundwater quality in the Santa Clara Valley Subbasin is generally high; however, some areas in the northern portion of the subbasin have high mineral content, and some areas in the southern basin have elevated nitrate concentrations (DWR 2003). Also, a number of groundwater contaminant plumes (primarily fuels and chlorinated solvents) are present locally. According to SCVWD and SFRWQCB data (SFRWQCB et al. 2003), the plumes are generally at least a mile from the salt ponds.

The Saltwater Intrusion Investigation by the SCVWD indicated the maximum areal extent of saltwater intrusion (as indicated by chloride concentrations above 100 ppm) by the mid-1970s was as far southeast as the intersection of U.S. 101 and Interstate Highway 880 (I-880). The salinity intrusion was apparently driven by the movement of saline waters from the Bay up the Guadalupe River and Coyote Creek, during high tides and low stream flow. Salinity intrusion from the waterways was exacerbated by subsidence and dredging. The Bay muds were shown to be leaky and to allow for downward migration of salinity into the upper aquifer zone. High salinity was also present in the lower aquifer zone beneath San Jose along the Guadalupe River and in the Palo Alto area. SCVWD data indicate that salinity remains elevated in the upper aquifer as much as 5 to 6 miles inland (southeast) of the salt ponds along the Guadalupe River and Coyote Creek.

Groundwater monitoring data in the Alviso pond complex from SCVWD’s Salinity Intrusion Monitoring Program indicate elevated salinity levels in shallow wells (screened above 100 feet below msl) within and

[3] Saltwater intrusion is characterized by the movement of saline water into a freshwater aquifer. Groundwater pumping can reduce or reverse seaward flow, causing seawater to enter and penetrate inland aquifers.
[4] SCVWD has a contract for 100,000 acre-feet per year of water from the State Water Project, delivered via the Harvey O. Banks Pumping Plant in the southern delta and the South Bay Aqueduct.

near the salt ponds. For example, data at the well cluster on Alviso Slough near the boundary between Ponds A7 and A8 indicate very low chloride concentrations in the two wells screened below 250 feet msl, but high chloride concentrations in the shallow aquifer zone (19,500 mg/L).

Groundwater quality data are limited in the San Mateo Subbasin (including the Ravenswood pond complex) because there is no groundwater management agency in the San Mateo Subbasin and hence no groundwater monitoring. Salinity intrusion was a historic problem in the basin in the mid-1900s, and most municipal wellfields were abandoned with the delivery of imported surface water. Groundwater conditions similar to those in and adjacent to the other pond complexes were assumed, with elevated salinity in the shallow aquifer zone.

Project Setting

Alviso-Island Ponds

The Alviso-Island pond cluster is at the southeastern extent of the Bay near Coyote Creek. Tidal flows were restored to these ponds in March 2006 as part of the tidal marsh restoration actions implemented under the ISP. Five breaches were cut along the south side of the ponds to allow full tidal inundation. This restoration approach is a minimally engineered, passive design that relies on the natural sedimentation processes to restore the ponds to tidal marsh habitat. The overall restoration goal is to reestablish vegetation, promote recolonization by benthic organisms, and provide habitat for various wildlife species.

Breaching these ponds has facilitated sediment accretion within the ponds. Sediment has accumulated relatively rapidly within the ponds since levee breaching (approximately twice as fast as typical marshes), and concurrently sediment has accumulated on adjacent mudflats on Coyote Creek and Mud Slough. The pond nearest the Bay, Pond A21 has filled in the fastest. Within five years, vegetation is well-established and a range of birds and fish are using it for habitat. The second pond from the Bay, Pond A20 is beginning to vegetate. The third pond, Pond A19 has changed the least. At the Island Ponds, proximity to the Bay seems to be an important factor for accretion, but other factors such as starting elevation and circulation are also key contributors to sedimentation rates.

Large-scale erosion of the adjacent mudflats and tidal marshes has not been observed (Callaway et al. 2013). The increased sediment demand is likely to have been met by local tributaries, sediment influx from the Bay, and/or from other nearby sediment sources. Sediment concentrations in the Island Ponds are expected to be similar to concentrations found in suspended sediments of the lower South Bay.

Total mercury and methylmercury concentrations were analyzed in sediment cores from Ponds A19, A20, and A21 collected in the winter of 2004, before breaching the Island Ponds. Total mercury concentrations ranged from 0.11 to 0.25 mg/kg, which is similar to or less than average concentrations in the Bay. Methylmercury concentrations ranged from 0.68 to 1.69 µg/kg, which is similar to or greater than concentrations in surrounding areas in the lower South Bay (Grenier, L, 2010).

Alviso-Mountain View Ponds

The Alviso-Mountain View pond cluster, in the western portion of the Alviso pond complex, includes Ponds A1 and A2W and the City of Mountain View’s Charleston Slough. The Mountain View Ponds are currently operated for limited directional circulation through Ponds A1 and A2W. There is a 48-inch intake structure in Pond A1, a 72-inch siphon between Ponds A1 and A2W, and an 48-inch outlet structure to the Bay from Pond A2W (see Figure 3.2-3 in Section 3.2, Hydrology, Flood Management, and Infrastructure). The water circulation system is operated to control dissolved oxygen problems and associated odors in these ponds. The sediment concentrations in these ponds are expected to be similar to or less than the concentrations found in suspended sediments of the lower South Bay.

Charleston Slough is a muted tidal system. A levee and a large, two-way tide gate were constructed across the outer end of the slough several decades ago. At the landward side of the slough (at the Coast Casey Forebay), the City of Mountain View has a water intake system to supply almost 10 million gallons per day of water to Shoreline Park's sailing lake. The lake's outflow is into Permanente Creek (which connects to Mountain View Slough). Within the largely contained, leveed portion of Charleston Slough, there is a main channel connecting the tide gate to the pump intake; this channel is thought to be maintained by the pumping itself. The rest of the inner slough is muted tidal mudflat.

Total mercury and methylmercury concentrations were analyzed in sediment cores from Ponds A1 and A2W collected in late summer or fall of 2004. Total mercury concentrations ranged from 0.30 to 0.31 mg/kg, which is greater than average concentrations found in the Bay. Methylmercury concentrations ranged from 0.32 to 2.54 µg/kg, which is both less than and greater than the concentrations in other parts of the surrounding areas in the lower South Bay (USGS 2005).

Alviso-A8 Ponds

The Alviso-A8 pond cluster is within the Alviso pond complex between Alviso and Guadalupe Sloughs in the lower South Bay. The A8 pond system is operated to maintain muted tidal circulation through Ponds A5, A7, A8, and A8S. The Pond A8 reversible, variable-sized notch was installed as part of Phase 1 actions, and extensive mercury studies in and around Pond A8 and adjacent sloughs have been conducted at the notch as part of the adaptive management actions.

The SBSP Restoration Project has monitored salinity, pH, temperature, and dissolved oxygen at the discharge notch in the Pond 8 levee and in the surrounding sloughs after implementation of the Phase 1 improvements. Average salinity concentrations at the notch ranged from approximately 7 to 14 ppt during the 2011 spring and summer monitoring period and were comparable to near-bottom concentrations found in Alviso Slough. Average pH concentrations ranged from 7.9 to 9.1 pH units, and average dissolved oxygen concentrations ranged from about 2.4 to 14.0 mg/L during that same period (USFWS and USGS 2012). Salinity levels in the Pond A5, A7, A8 system decreased in 2011 after the Pond A8 notch was opened (relative to the 2010 values). Dissolved organic carbon, total suspended solids (TSS), and particulate organic carbon concentrations also decreased (Ackerman, J.T., et.al., 2013).

Monitoring for the South Baylands Mercury Project (2006–2007) has found total mercury concentrations in Pond A8's water ranging from 7 to 230 ng/L and methylmercury concentrations ranging from 0.25 to 10.2 ng/L before installation of the Pond A8 notch. The average total mercury concentration in Pond A8 was greater than the average concentrations found in Alviso Slough and Alviso Marsh (60 ± 10 ng/L compared to 23 ± 4 ng/L and 21 ± 4 ng/L, respectively). The average methylmercury concentration in Pond A8 was substantially greater than the average concentrations found in Alviso Slough and Alviso Marsh (2.88 ± 0.44 ng/L compared to 0.38 ± 0.11 ng/L and 0.52 ± 0.24 ng/L) (Grenier et al. 2010). Sediment concentrations of methylmercury in Pond A8 were generally found to be greater than the methylmercury concentrations in Alviso Slough and Alviso Marsh (Grenier et al. 2010; Marvin-DiPasquale 2013). This study also found that the bioavailability and bioaccumulation of mercury was greater in Pond A8 than in either Alviso Slough or the fringing tidal marsh around the slough channel and the A8 Ponds. Methylmercury concentrations in water and sediment were greater in Pond A8 than in

Alviso Slough or its fringing tidal marsh channels, and biosentinels representing benthic and shoreline habitats indicated more mercury bioaccumulation in Pond A8 than in the tidal marshes along Alviso Slough (Grenier et al. 2010).

The SBSP Restoration Project's science team summarized the results of the recent monitoring of the A8 Ponds and surrounding waterways conducted as a part of the AMP (Valoppi, L., 2015). The results of the 2013 study found that Forster's tern egg mercury concentrations decreased by 59 percent between 2011 and 2013 at restored ponds, compared to a decline of 23 percent between these years at reference ponds. The end result of this 3-year comparison was that tern egg mercury concentrations decreased between 2010 and 2013 by 31 percent at both restored ponds and reference ponds. Despite the dramatic increase observed right after Pond A8 was opened in 2011 and correspondingly large decrease (2011 to 2013) in tern egg mercury concentrations at the restored ponds, tern egg mercury concentrations in the restored ponds are currently at levels that are similar to what would have been expected without the restoration actions. Results from the collection of slough fish for mercury analysis in 2013 did not appear to show major increases in sentinel slough fish mercury concentrations in relation to the opening of the Pond A8 notch to triple its previous volume (2011 = 1 gate [5 feet]; 2013 = 3 gates [15 feet]). Bathymetric survey data from 2010 to November 2013 showed continued erosion and deposition occurring, with a net scour of about 16 cm throughout the slough. Mercury remobilization occurred mostly near the Pond A6 breaches, but also some mercury is being remobilized near Pond A8. Researchers estimate that, between 2010 and November 2013, between 21 to 24 kilograms (kg) of total mercury have been remobilized in Alviso Slough with up to three gates open, compared to a previously predicted amount of 66 kg of total mercury released with four gates open (20 feet). The SBSP Restoration Project is working with researchers to develop an Alviso Slough scour model to help understand the main causes of slough scour and mercury remobilization.

Results from 2014 and 2015 mercury studies found similar trends as in 2013. The results of the 2014 study found that bird egg mercury concentrations were about the same levels as were observed in 2013, at levels expected had the restoration actions not occurred. Tern eggs results from 2015 also found mercury levels similar between restored and reference ponds, though both sites had increased mercury levels above 2013 and 2014. The increase is due to the normal variability in mercury levels from year to year and not due to restoration or management actions. Similarly, pond and slough fish mercury levels were also variable, but levels in 2014 and 2015 were what would be expected had the restoration actions not occurred. Water samples of mercury in the pond and sloughs supported the conclusions from the fish sampling. So in summary, opening Pond A8 gates from 1 in 2011 to 5 in 2014/5 resulted in no appreciable net increase in mercury levels in birds or fish (Valoppi 2016).

Total mercury concentrations were analyzed in the sediment cores collected in Alviso Slough in May 2012. With the exception of the sediments near the bayward side of Pond A6, total mercury concentrations in the upper 80 centimeters of Alviso Slough sediments were generally greater than the average concentrations in the lower South Bay. Alviso Slough sediments near the Pond A8 notch ranged from 0.6 to 1.0 mg/kg of total mercury in the upper 60 centimeters of the sediment cores. Upstream areas of Alviso Slough were found to have concentrations of up to 3.25 mg/kg (Marvin-DiPasquale 2013).

Alviso Slough scour results in 2014/5 show that even with opening the gates early, there was not appreciably more erosion in Alviso Slough. Overall, there are some areas of deposition in the slough not previously observed, likely due to redistribution of sediments in the channel. Most of the erosion continues to be associated with the Pond A6 breaches, not the opening of the gates at the Pond A8 notch. For the first time gates were open in winter in 2014, and more erosion in the upper part of slough and rest of slough from April 2014 to April 2015 were observed. But from April 2015 to Oct 2015, deposition in slough in Spring and Summer occurred, even though all 5 gates were open. From 2010 to October 2015 about 35kg to 39 kg total Hg remobilized over the entire length of slough with about ~64 % from the zone near the A6 breaches. About 1/3 of the total is immediately near A6 breaches. The smallest Hg remobilization amount is near the A8 notch (5-10%). Preliminary results of a slough scour model support that even opening all 8 gates would have limited impact over the short term on scour in Alviso Slough above the Pond A6 breaches (Valoppi 2016).

Ravenswood Ponds

The Ravenswood pond cluster (Ponds R3, R4, R5, and S5) are operated as seasonal ponds. Seasonal ponds are passively managed; they receive direct precipitation, groundwater inflows, and minimal overland runoff during the wet season. During the dry season, the ponds are allowed to dry out by seepage and evaporation and are thus dry salt pannes for more than half of the year. However, the borrow ditches and historic slough traces do retain water. Salinities and metal concentrations in sediments and in the ditches and slough traces are expected to be elevated in comparison to concentrations in open Bay water because of concentration by evaporation. The dry salt pannes in Ponds R3 and R4 are good nesting habitat for the western snowy plover (*Charadrius nivosus nivosus*), which prefers relatively remote beaches, gravel beds, or other unvegetated terrain.

Total mercury and methylmercury concentrations were analyzed in sediment cores from Pond R4 collected in late summer or fall of 2003. Total mercury concentrations averaged 0.05 mg/kg, which is lower than typical concentrations found in the Bay. Methylmercury concentrations averaged 0.37 µg/kg, which is also less than concentrations generally found in the Bay (USGS 2005).

3.3.2 Regulatory Setting

Regulatory Authorities and Enabling Legislation

Federal and state agencies are authorized to ensure adequate surface water, sediment, and groundwater quality with respect to potential restoration impacts. The agencies, their enabling legislation, and their roles in establishing and implementing policies are described below.

The United States Environmental Protection Agency (USEPA) carries out the mandates set forth in federal Clean Water Act (CWA). The CWA requires that waters of the United States be protected by adopting and implementing a program of water quality standards. Water quality standards consist of defined beneficial uses of water and numeric or narrative criteria to protect those beneficial uses. The USEPA is authorized to delegate its authority to state agencies. In situations where a state fails to carry out the mandates of the CWA by enacting policies and regulations, the USEPA is authorized to promulgate federal regulations by which the state must abide. This federal-state relationship is the basis for USEPA's promulgation of the California Toxics Rule (CTR), which establishes numeric criteria for toxic pollutants.

In California, the State Water Resources Control Board (SWRCB) is the lead agency with delegated authority to implement the CWA. The SWRCB's authority is enabled by California's Porter-Cologne Water Quality Control Act (Porter-Cologne). The SWRCB is responsible for implementing statewide water quality standards programs. The SWRCB has delegated many duties to the nine Regional Water Quality Control Boards (RWQCBs), which are defined by distinct hydrologic regions. The SBSP Project

Restoration area is within the jurisdiction of the SFRWQCB. The SFRWQCB is responsible for developing the water quality standards that are adopted in the Water Quality Control Plan for San Francisco Bay (Basin Plan) after following the scientific and public review procedures set forth in Porter-Cologne Sections 13240–13245. The Basin Plan lists the beneficial uses of water and the water quality objectives[5] to protect those beneficial uses. The beneficial uses and water quality objectives are described below under "Existing Water Quality Standards Programs."

The Basin Plan also includes a plan of implementation that guides the SFRWQCB in carrying out its duties. Those duties include:

- Issuing National Pollutant Discharge Elimination System (NPDES) permits, as authorized by CWA Section 402, to regulate discharges to navigable waters of the United States and their tributaries;
- Issuing state waste discharge requirements, as authorized by Porter-Cologne Sections 13260–13274, to regulate discharges to land and other discharges not requiring federal NPDES permits;
- Issuing water quality certifications as authorized by CWA Section 401 to projects with a federal component that may affect water quality, such as dredging and filling activities that require a CWA Section 404 certification from the United States Army Corps of Engineers;
- Issuing conditioned waivers of waste discharge requirements, as authorized by Porter-Cologne Section 13269, for discharges and other activities that are not considered to threaten the beneficial uses of waters;
- Requiring monitoring data from permitted dischargers, as authorized by Porter-Cologne Sections 13225-c and 13267; and
- Conducting enforcement, as authorized by Porter-Cologne Sections 13300–13365, against parties that fail to apply for necessary permits or comply with existing permits and requirements.

The SFRWQCB also participates in many regional collaborative programs to monitor water quality and implement projects to protect and improve water quality. Examples of such collaborations include the San Francisco Bay RMP, the San Francisco Bay Area Wetlands Regional Monitoring Program, the San Francisco Bay Clean Estuary Partnership, and the SWRCB's Surface Waters Ambient Monitoring Program. The SFRWQCB is also responsible for administering water-quality-related state grant programs. Although these programs are outside of the core regulatory duties of the SFRWQCB, they are important resources for the monitoring and adaptive management phase of the SBSP Restoration Project.

There are two publicly owned water districts responsible for groundwater resources in the SBSP Restoration Project area: Alameda County Water District and SCVWD.[6] Both of these agencies carry out their missions by operating groundwater recharge facilities, conducting monitoring at guard wells, ensuring that unused wells are properly abandoned, and encouraging water conservation by municipalities in their respective service areas.

[5] The distinction between objectives and criteria is important, as federal criteria are viewed as guidelines to be considered, whereas state-adopted objectives have force of law.
[6] Although there are public and private water agencies in San Mateo County, there is no groundwater management agency for the San Mateo Plain Subbasin (including the Ravenswood area).

In addition to protecting water supplies, the SCVWD is also charged with flood protection and stream stewardship. SCVWD flood protection projects are discussed in more detail in Section 3.2, Hydrology, Flood Management, and Infrastructure. The SCVWD stream stewardship mission is carried out through all of its operations, including the Clean Safe Creeks and Natural Flood Protection Program. This program is funded through a 15-year voter-approved benefits assessment. The program is designed to protect property from flooding; ensure that streams and creeks are kept clean; protect and enhance the ecosystem function of streams; and provide open spaces, parks, and trails along streams and creeks in the Santa Clara Valley. Implementation of program elements by SCVWD would improve the quality of freshwater upstream of the SBSP Restoration Project area.

The responsibility for protection of stormwater quality is assigned to the countywide stormwater programs in the SBSP Restoration Project area. The Santa Clara Valley Urban Runoff Pollution Prevention Program is a multi-agency program representing 14 municipal government co-permittees and the SCVWD. The Alameda Countywide Clean Water Program represents 15 municipal government co-permittees, the Alameda County Flood Control and Water Conservation District, and the Zone 7 Water Agency. Both of these stormwater programs implement stormwater quality management plans with regulatory oversight from the SFRWQCB. The stormwater quality management plans describe a coordinated program of monitoring, watershed assessment, inspections, illicit discharge control, construction controls, municipal maintenance, and public education.

Three publicly owned treatment works discharge highly treated water to shallow waters in the lower South Bay. In the vicinity of the Alviso pond complex, the San Jose/Santa Clara Water Pollution Control Plant discharges to Artesian Slough. The Sunnyvale Water Pollution Control Plant discharges to Moffett Channel, which discharges to Guadalupe Slough. The Palo Alto Regional Water Quality Control Plant discharges to a mudflat to the south of the Ravenswood pond complex. All three of these plants produce water treated to a sufficient quality to allow water recycling for irrigation and other uses. In the northern area of the South Bay, the East Bay Dischargers Authority operates a deep-water outfall in the Bay that discharges secondary-treated effluent from four different municipal treatment plants. Also, the Union Sanitary District operates a treatment wetland to the north of the Eden Landing pond complex. All of these municipal dischargers operate under NPDES permits issued and enforced by the SFRWQCB. Although there are no industrial dischargers in the South Bay, there are numerous ongoing cleanup operations in the region that extract groundwater, remove pollutants (primarily fuels and organic solvents), and discharge the treated groundwater under coverage by the NPDES general permit for groundwater discharge administered by the SFRWQCB. Periodic spills of toxic materials (e.g., brines, chemicals) are subject to enforcement by the SFRWQCB.

The California Department of Toxic Substances Control (DTSC) regulates hazardous wastes. It derives its authority from Title 22 of the California Code of Regulations. Any areas known to have hazardous wastes in need of remediation near the SBSP Restoration Project area would be listed in the DTSC Envirostar database (http://www.envirostor.dtsc.ca.gov/public/).

Existing Water Quality Standards Programs

San Francisco Bay Region Basin Plan and California Toxic Rule

The existing water quality standards program implemented by the SFRWQCB is defined in the Basin Plan. The Basin Plan lists numerous beneficial uses of water that apply in the project and regional setting. The most relevant beneficial uses are ocean, commercial, and sport fishing; estuarine habitat; industrial service supply; fish migration; navigation; preservation of rare and endangered species; contact and non-contact recreation; shellfish harvesting; spawning; reproduction and/or early development of fish; and wildlife habitat. Designated groundwater beneficial uses include municipal and domestic supply, agricultural supply, and industrial service supply.

To protect these beneficial uses, the Basin Plan lists both narrative and numeric water quality objectives for surface and groundwater. Narrative objectives provide general guidance to avoid adverse water quality impacts. Narrative objectives relevant to this analysis include salinity, sediment (i.e., TSS), sulfides, toxicity, biostimulatory substances, bioaccumulation, and population and community ecology. Those narrative objectives are listed in Table 3.3-1. Numeric water quality criteria included in the Basin Plan establish objectives for trace metals, dissolved oxygen, turbidity, temperature, pH, bacteriological pathogens, and un-ionized ammonia. Numeric water quality criteria are summarized in Tables 3.3-2 to 3.3-4.

The Basin Plan amendment for copper and nickel (adopted in June 2007) specifies site-specific objectives for copper in the Bay and site-specific objectives for nickel in the South Bay, as shown in Table 3.3-2. The implementation plan establishes copper control measures to prevent increases in ambient dissolved copper concentrations, and metal translators are used to provide a ratio for total to dissolved copper and nickel concentrations for segments of the Bay.

Table 3.3-1 Basin Plan Narrative Water Quality Objectives Relevant to this Analysis

OBJECTIVE	NARRATIVE
Toxicity	All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms. Detrimental responses include, but are not limited to, decreased growth rate and decreased reproductive success of resident or indicator species. There shall be no acute toxicity in ambient waters. Acute toxicity is defined as a median of less than 90 percent survival, or less than 70 percent survival, 10 percent of the time, of test organisms in a 96-hour static or continuous flow test. There shall be no chronic toxicity in ambient waters. Chronic toxicity is a detrimental biological effect on growth rate, reproduction, fertilization success, larval development, population abundance, community composition, or any other relevant measure of the health of an organism, population, or community. Chronic toxicity generally results from exposures to pollutants exceeding 96 hours. However, chronic toxicity may also be detected through short-term exposure of critical life stages of organisms. As a minimum, compliance will be evaluated using the bioassay requirements contained in Chapter 4 [of the Basin Plan]. The health and life history characteristics of aquatic organisms in waters affected by controllable water quality factors shall not differ substantially from those for the same waters in areas unaffected by controllable water quality factors.
Turbidity	Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases from normal background light penetration or turbidity relatable to waste discharge shall not be greater than 10 percent in areas where natural turbidity is greater than 50 NTU [nephelometric turbidity units].
Sediment	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. Controllable water quality factors shall not cause a detrimental increase in the concentrations of toxic pollutants in sediments or aquatic life.
Suspended material	Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.
Settleable solids	Waters shall not contain substances in concentrations that result in the deposition of material that cause nuisance or adversely affect beneficial uses.

Table 3.3-1 Basin Plan Narrative Water Quality Objectives Relevant to this Analysis

OBJECTIVE	NARRATIVE
Floating material	Waters shall not contain floating material, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.
Salinity	Controllable water quality factors shall not increase the total dissolved solids or salinity of waters of the state so as to adversely affect beneficial uses, particularly fish migration and estuarine habitat.
Sulfides	All water shall be free from dissolved sulfide concentrations above natural background levels. Sulfide occurs in Bay muds as a result of bacterial action on organic matter in an anaerobic environment. Concentrations of only a few hundredths of a milligram per liter can cause a noticeable odor or be toxic to aquatic life. Violation of the sulfide objective will reflect violation of dissolved oxygen objectives as sulfides cannot exist to a significant degree in an oxygenated environment.
Oil and grease	Waters shall not contain oils, greases, waxes, or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses.
Biostimulatory substances	Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses. Changes in chlorophyll-a and associated phytoplankton communities follow complex dynamics that are sometimes associated with a discharge of biostimulatory substances. Irregular and extreme levels of chlorophyll-a or phytoplankton blooms may indicate exceedance of this objective and require investigation.
Bioaccumulation	Many pollutants can accumulate on particles, in sediment, or bioaccumulate in fish and other aquatic organisms. Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life. Effects on aquatic organisms, wildlife, and human health will be considered.
Population and community ecology	All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce significant alterations in population or community ecology or receiving water biota. In addition, the health and life history characteristics of aquatic organisms in waters affected by controllable water quality factors shall not differ substantially from those for the same waters in areas unaffected by controllable water quality factors.
Dissolved oxygen	For all tidal waters, the following objectives shall apply in the Bay: Downstream of Carquinez Bridge 5.0 mg/L minimum Upstream of Carquinez Bridge 7.0 mg/L minimum For nontidal waters, the following objectives shall apply to waters designated as: Cold water habitat 7.0 mg/L minimum Warm water habitat 5.0 mg/L minimum The median dissolved oxygen concentration for any three consecutive months shall not be less than 80 percent of the dissolved oxygen content at saturation. Dissolved oxygen is a general index of the state of the health of receiving waters. Although minimum concentrations of 5 mg/L and 7 mg/L are frequently used as objectives to protect fish life, higher concentrations are generally desirable to protect sensitive aquatic forms. In areas unaffected by waste discharges, a level of about 85 percent of oxygen saturation exists. A three-month median objective of 80 percent of oxygen saturation allows for some degradation from this level, but still requires a consistently high oxygen content in the receiving water.

Table 3.3-2 **Basin Plan Surface Water Objectives for Metals (µg/L)**

	WATER QUALITY OBJECTIVE SOUTH OF HAYWARD SHOALS		WATER QUALITY OBJECTIVE NORTH OF HAYWARD SHOALS	
	CONTINUOUS (4-DAY AVERAGE)	MAXIMUM (1-HOUR AVERAGE)	CONTINUOUS (4-DAY AVERAGE)	MAXIMUM (1-HOUR AVERAGE)
Arsenic	36	69	36	69
Cadmium	9.3	42	9.3	42

	WATER QUALITY OBJECTIVE SOUTH OF HAYWARD SHOALS		WATER QUALITY OBJECTIVE NORTH OF HAYWARD SHOALS	
	CONTINUOUS (4-DAY AVERAGE)	MAXIMUM (1-HOUR AVERAGE)	CONTINUOUS (4-DAY AVERAGE)	MAXIMUM (1-HOUR AVERAGE)
Chromium	50	1100	50	1100
Copper	6.9	10.8	6.0	9.4
Lead	8.1	210	8.1	210
Nickel	11.9 [1]	62.4 [1]	8.2	74
Selenium (total recoverable)	5	20	5	20
Silver	—	1.9	—	1.9
Zinc	81	90	81	90

[1] Lower South Bay (south of Dumbarton Bridge)
Hayward Shoals = Little Coyote Point to the Oakland Airport

Table 3.3-3 Other Numeric Surface Water Criteria

PARAMETER	EVALUATION CRITERIA
Dissolved oxygen	5 mg/L[1, 5]
Mercury (total, including organic compounds)	0.051 µg/L,[2, 6] see also Table 3.3-4, below
PCBs	0.17 ng/L[2, 7]
PAHs	15.0 µg/L[1, 8]
Dioxins and furans	0.014 picogram (pg)/L[3 ,9]
Chlordanes	2.2 ng/L[2]
DDTs	0.59 ng/L[2]
TPH-diesel	200 mg/L[4]

Notes:

1 SFRWQCB, Water Quality Control Plan, San Francisco Bay Basin. Surface waters greater than 10 ppt salinity.

2 40 CFR Part 131.38 (California Toxics Rule [CTR]), May 18, 2000.

3 National Recommended Water Quality Criteria – Correction, USEPA, April 1999.

4 USEPA Multi-Sector Permit Benchmark Values.

5 Dissolved oxygen = water quality objective for tidal waters downstream of Carquinez Bridge.

6 Mercury = 0.051 µg/L, 30-day average (CTR). Applies south of Dumbarton Bridge.

7 PCB = 30-day average, water quality criteria value for human health for consumption of organisms, 10^{-6} risk.

8 PAH = water quality objective for 24-hour averaged level, salinity over 10 ppt.

9 Dioxins and furans = water quality criteria value for human health for consumption of organisms, 10^{-6} risk.

Table 3.3-4 Numeric Criteria for Mercury

TOTAL MERCURY WATER QUALITY OBJECTIVES		
LOCATION	WATER QUALITY OBJECTIVE FOR TOTAL MERCURY	SOURCE
San Francisco Bay	2.1 µg/L 1-hour average in water	Basin Plan
	0.2 mg/kg in fish, trophic level 3 and 4 (larger fish which humans consume)	Basin Plan
	0.03 mg/kg in fish, 3 to 5 cm in length (smaller fish which wildlife consumes)	Basin Plan
South of the Dumbarton Bridge	0.051 µg/L 30-day average in water	CTR objective (applies in addition to the three Basin Plan objectives)
Notes: Both the current and proposed Basin Plan objectives listed above are applicable in marine waters— those in which the salinity is equal to or greater than 10 ppt 95 percent of the time. For waters in which the salinity is between fresh and marine, that is between 1 and 10 ppt, the applicable objectives are the more stringent of the freshwater or marine objectives. For mercury, the marine objectives are more stringent.		

The Basin Plan amendment adopting the Bay Total Maximum Daily Load (TMDL) for mercury (approved in February 2008) includes numeric water quality objectives for mercury concentrations in fish. Although water quality criteria and objectives are traditionally expressed as mass of pollutant per unit mass of water (e.g., µg/L), the Clean Water Act enables expression of criteria and objectives in alternative units. For bioaccumulative pollutants such as mercury, guidance by USEPA requires states to develop numeric criteria or objectives that are based on pollutant concentrations in fish tissue and then implement the tissue-based criteria or objectives by translating the tissue-based values to water-based and sediment-based metrics. The fish tissue TMDL targets for the Bay mercury TMDL are 0.2 mg/kg for trophic level 3 and trophic level 4 fish, and 0.03 mg/kg for smaller fish (3 to 5 centimeters in length) that are the prey of wildlife. These objectives are summarized in Table 3.3-4. To achieve the human health and wildlife targets and to attain water quality standards, the Bay-wide suspended sediment mercury concentration target was set at 0.2 mg/kg mercury in dry sediment. (This does not translate directly to a numeric guideline for sediments within the SBSP Restoration Project area. Rather, the evaluation of impacts considers the potential of a project activity to raise or lower the average concentration of mercury in the Bay near where the activity takes place.)

The Basin Plan amendment adopting the TMDL for PCBs in the Bay (approved in March 2010) includes a fish tissue concentration target that is used to protect beneficial uses. A sediment concentration goal of 1 µg/kg PCBs is used to support the fish tissue target of 10 µg/kg wet weight. Currently, ambient Bay sediments are approximately ten-fold higher than the sediment concentration goal of 1 µg/kg. The impact of project activities on the concentration of PCBs in ambient Bay sediments has been evaluated with reference to this goal and other environmental indicators of ecological risk, as appropriate.

In addition to the Basin Plan, the CTR specifies numeric aquatic life criteria for 23 priority toxic pollutants and numeric human health criteria for 57 priority toxic pollutants. These criteria apply to all inland surface waters and enclosed bays and estuaries of the San Francisco Bay region, although Tables 3-3 and 3-4 of the Basin Plan include numeric water quality objectives for certain of these priority toxic pollutants that supersede the CTR criteria (except south of the Dumbarton Bridge). Human health criteria are further identified as for consumption of "water and organisms" and "organisms only." These objectives are applied with consideration to the beneficial use of the waterbody.

Applicable objectives are affected by both geography and salinity. Numeric and narrative objectives from the Basin Plan and most CTR numeric criteria apply to Bay waters. The Basin Plan and the CTR also establish different numeric objectives for freshwater and saltwater. Freshwater is defined as having salinity less than 1 ppt more than 95 percent of the time, whereas saltwater is defined as having salinity greater than 10 ppt more than 95 percent of the time. Conditions between these two endpoints define estuarine waters, in which case the more stringent (lower) of either the freshwater or the saltwater objectives apply.

SWRCB Sediment Quality Objectives

The SWRCB sediment quality objectives are based on chemical concentrations, bioassays, and benthic community conditions. The *Water Quality Control Plan for Enclosed Bays and Estuaries*, Part 1, *Sediment Quality* (SWRCB 2009) contains the following narrative water quality objective: “Pollutants in sediments shall not be present in quantities that, alone or in combination, are toxic to benthic communities in bays and estuaries of California.” This Water Quality Control Plan became effective in August 2009, supersedes other narrative sediment quality objectives, and establishes new sediment quality objectives and related implementation provisions for specifically defined sediments in most bays and estuaries.

LTMS Guidelines

There is guidance for sediment assessment in the Beneficial Reuse of Dredged Materials: Sediment Screening and Testing Guidelines (San Francisco Bay Long-Term Management Strategy (LTMS) Guidelines; SFRWQCB 2000). The LTMS Guidelines define statistically determined San Francisco Bay ambient sediment concentrations and ecological thresholds (Table 3.3-5). The ambient concentrations are established through previous sampling efforts around “unimpacted” areas of San Francisco Bay. The ecological thresholds defined in the LTMS Guidelines are the Effects Range–Low (ER-L) and the Effects Range–Median (ER-M) established by the National Oceanic and Atmospheric Administration (NOAA). ER-Ls represent the concentration below which adverse biological effects are unlikely, and ER-Ms represent the concentrations above which adverse biological effects are likely. The LTMS Guidelines are not a set of regulatory objectives.

In general, the SFRWQCB considers sediment with concentrations less than ambient levels to be acceptable for wetland cover material (the upper 3 feet), and sediment with concentrations less than ER-Ms are acceptable for wetland foundation material (greater than 3 feet below current or designed ground surface elevations). (However, for PCBs the ER-L is used as a guideline for cover material.) For some chemical constituents, the ambient value is greater than the respective ER-L. However, the SFRWQCB acknowledges that it is not practical to regulate to concentrations “cleaner” than ambient conditions.

Table 3.3-5 LTMS Sediment Guidance

CHEMICAL CONSTITUENT	SAN FRANCISCO ESTUARY SEDIMENT AMBIENT CONCENTRATIONS (MG/KG)	EFFECTS RANGE-LOW, ER-L (MG/KG)	EFFECTS RANGE-MEDIAN, ER-M (MG/KG)
Metals			
Arsenic	15.3	8.2	70
Cadmium	0.33	1.2	9.60
Chromium	112	81	370

Table 3.3-5 LTMS Sediment Guidance

CHEMICAL CONSTITUENT	SAN FRANCISCO ESTUARY SEDIMENT AMBIENT CONCENTRATIONS (MG/KG)	EFFECTS RANGE-LOW, ER-L (MG/KG)	EFFECTS RANGE-MEDIAN, ER-M (MG/KG)
Copper	68.1	34	270
Lead	43.2	46.7	218
Mercury	0.43	0.15	0.71
Nickel	112	20.9	51.6
Selenium	0.64	-	-
Silver	0.58	1	3.7
Zinc	158	150	410
Pesticides			
Aldrin	0.0011		
Dieldrin	0.00044	0.000715 [1]	0.0043 [2]
p,p'-DDD	-	0.00122 [1]	0.00781 [2]
p,p'-DDE	-	0.00220	0.027
p,p'-DDT	-	0.00119 [1]	0.00477 [2]
Endrin	0.00078	-	-
Hexachlorobenzene	0.000485	-	-
Sum of chlordanes (SFEI list)	0.0011	0.00226 [1]	0.00479 [2]
Sum of DDTs (SFEI list)	0.007	0.00158	0.0461
Sum of HCH (SFEI list)	0.00078	-	-
Sum of PCBs (SFEI list)	0.0216	0.0227	0.18
PAHs			
1-Methylnaphthalene	0.0121	-	-
1-Methylphenanthrene	0.0317	-	-
2,3,5-Trimethylnaphthalene	0.0098	-	-
2,6-Dimethylnaphthalene	0.0121	-	-
2-Methylnaphthalene	0.0194	0.07	0.67
2-Methylphenanthrene	0.0266	-	-
Acenaphthene	0.0317	0.016	0.5
Acenaphthylene	0.0266	0.044	0.64
Anthracene	0.088	0.0853	1.1
Benz(a)anthracene	0.244	0.261	1.6
Benzo(a)pyrene	0.412	0.43	1.6
Benzo(b)fluoranthene	0.371	-	-
Benzo(e)pyrene	0.294	-	-
Benzo(g,h,i)perylene	0.310	-	-
Benzo(k)fluoranthene	0.258	-	-
Biphenyl	0.0129	-	-
Chrysene	0.289	0.384	2.8
Dibenz(a,h)anthracene	0.0327	0.0634	0.26
Fluoranthene	0.514	0.6	5.1
Fluorene	0.0253	0.019	0.54
Indenol(1,2,3-c,d)pyrene	0.382	-	-
Naphthalene	0.0558	0.16	2.1
Perylene	0.145	-	-

Table 3.3-5 LTMS Sediment Guidance

CHEMICAL CONSTITUENT	SAN FRANCISCO ESTUARY SEDIMENT AMBIENT CONCENTRATIONS (MG/KG)	EFFECTS RANGE-LOW, ER-L (MG/KG)	EFFECTS RANGE-MEDIAN, ER-M (MG/KG)
Phenanthrene	0.237	0.24	1.5
Pyrene	0.665	0.665	2.6
Sum of HPAHs (SFEI list)	3.060	1.7	9.6
Sum of LPAHs (SFEI list)	0.434	0.552	3.16
Sum of PAHs (SFEI list)	3.390	4.022	44.792

Notes:

[1] Threshold Effects Level, as established by the Florida Department of Environmental Protection (FDEP); no ER-L was established.

[2] Probable Effects Level, as established by the FDEP; no ER-M was established.

Waste Discharge Requirements

The SFRWQCB has issued waste discharge requirements to the USFWS and the California Department of Fish and Wildlife (CDFW) for discharges from the SBSPs and for ongoing maintenance activities. Water Quality Order No. R2-2004-0018 was issued in conjunction with actions taken under the ISP and Water Quality Order No. R2-2008-0078, as revised by R2-2012-0014, was issued for Phase 1 actions (SFRWQCB 2006, 2008, 2012). These requirements permit discharge from certain ponds under an initial release scenario where high salinities discharged from certain ponds may impact beneficial uses in the short term, but impacted areas are expected to fully recover within 1 year. The initial release refers to the time expected to substantially empty salt ponds of their current contents. These requirements also permit subsequent discharge from these ponds as waters from the South Bay are taken into pond systems and then discharged more-or-less continuously (continuous circulation). For the continuous circulation period, the pond systems are required to be managed to ensure beneficial uses remain protected.

The main parameters of concern initially identified by the SFRWQCB include salinity, metals, dissolved oxygen, pH, and temperature. Subsequent permits also identify mercury, nutrients, and algae. Discharge limitations specified by the order include numeric criteria for salinity during the initial discharge and during continuous circulation, dissolved oxygen, pH, and temperature. (Salinity is used as an indicator parameter for the concentrations of metals—concentrations of metals were considered to not impact Bay waters if the salinity of the discharge was limited to 44 ppt.) Water Quality Order No. R2-2008-0078 also specifies receiving water limitations effective at the contour line for mean lower-low water level (i.e., 0 foot elevation, North American Vertical Datum of 1988 [NAVD88]) for dissolved oxygen, dissolved sulfate, pH, ammonia, nutrients, and turbidity. The order also acknowledges that ponds and sloughs have variable dissolved oxygen levels and often are below the 5.0 mg/L objective due to algal activity.

As indicated in the SBSP waste discharge requirements, the SFRWQCB expects that the SBSP Restoration Project would create net environmental benefits with respect to water quality and beneficial uses. The SFRWQCB indicates that restoring tidal wetland functions to former salt ponds would improve water quality in the South Bay estuary on a spatially significant scale with large contiguous habitat to maximize transitional habitat (ecotones) and minimize non-native vegetation (if appropriate management efforts are taken to control non-native species). Marsh systems that are tidally connected to the estuary improve water quality by filtering and fixing pollutants in addition to protecting beneficial uses by providing nursery habitat and protection from predation for native fish species, significant biological productivity to the estuarine system, and habitat for rare and endangered species. Successful restoration would also provide shallow-water habitat for migrating shorebirds and foraging and nesting islands for birds. Operating former salt ponds as managed ponds is considered by the SFRWQCB to be a transitional phase between salt-making and restoration. This transitional pond management phase for most of the former salt ponds would benefit the environment in the near term by providing shallow open water habitat for shorebirds, thus avoiding the consequences of operating them as seasonal ponds. In addition to habitat and water quality benefits, tidal marsh restoration would also help protect communities from floods, storms, and sea-level rise.

Emerging Programs of Water Quality Standards

Emerging programs that may result in new water quality or sediment quality criteria include:

- The SFRWQCB is working with the SWRCB, the Southern California Coastal Water Research Program, and SFEI to develop nutrient numeric endpoints for the Bay to address nutrient over-enrichment (eutrophication) in state waters.
- Trash could be listed as an impairing pollutant in many urban creeks, including the Guadalupe River and Coyote Creek during the lifetime of this project. Measures to reduce trash would likely be implemented through the Municipal Regional Permit for stormwater; if these do not succeed, a trash TMDL is a potential next regulatory step. Pathogens could follow a similar trajectory.

New objectives resulting from these programs are considered in the evaluation of impacts.

3.3.3 Environmental Impacts and Mitigation Measures

Overview

The potential to exceed the thresholds of significance for each impact is evaluated and summarized below. Impact evaluations for the Action Alternatives are assessed based on the existing conditions and the anticipated future conditions that would occur under the No Action Alternative. In this case, the No Action Alternative represents no change from current management direction, practices, or level of management intensity provided in the AMP and USFWS's pond operations plan. Under each potential impact, the likelihood of occurrence and the potential for mitigation are discussed. If there is considerable uncertainty about the likelihood of occurrence, the information needed to reduce the uncertainty is described.

Significance Criteria

For the purposes of this Final EIS/R, the project is considered to have adverse impacts on water quality or groundwater resources if it would:

- Violate water quality standards or otherwise substantially degrade water quality; or
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge.

The SBSP Restoration Project alternatives would not interfere with groundwater recharge or deplete groundwater supplies through groundwater extraction. Potable groundwater supplies could be affected by changes in salinity.

For the purpose of this impact assessment, the thresholds of significance are applied to changes from baseline conditions that result from factors within the control of the project proponents. Ambient water quality in the Bay itself, though discussed in the impact sections, is considered outside the control of the project proponents.

Water Quality

Thresholds of significance are used to define indicators of significant environmental impacts. In general, thresholds should be objective and based on existing standards (see Tables 3.3-1 to 3.3-5). Some potential impacts have also been identified as “staircase issues” for the AMP. The “restoration staircase” was a concept developed for the SBSP Restoration Project at its program-level and was included in the 2007 EIS/R. Staircase issues are areas of uncertainty for which it is difficult to predict specific outcomes based on the available data and current understandings of the system. The staircase issues are being addressed through the AMP, which includes monitoring to measure and track actual outcomes of management and restoration actions, together with predefined triggers designed to detect adverse outcomes early on, before they reach levels of significance. Corrective actions can thus be developed and implemented before the thresholds of significance are reached. If monitoring indicates that no adverse impacts are occurring, then the planned restoration can continue along the staircase to the next step. For water quality impacts, the staircase issues are (1) changes in algal composition leading to nuisance algal blooms; (2) algal blooms leading to low dissolved oxygen levels; (3) increased mercury methylation and bioaccumulation, and (4) mobilization and transport of mercury-contaminated sediments and other pollutants. Triggers for adaptive management actions are typically established well below the thresholds of significance to ensure that the thresholds of significance are not exceeded.

Threshold for Changes in Algal Composition and Abundance

Project activities that lead to unacceptable increases in algal abundance would be deemed to have significant impacts if the SFRWQCB narrative water quality objective for biostimulatory substances is violated:

> Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses. Changes in chlorophyll-a and associated phytoplankton communities follow complex dynamics that are sometimes associated with a discharge of biostimulatory substances. Irregular and extreme levels of chlorophyll a or phytoplankton blooms may indicate exceedance of this objective and require investigation.

Concerns over nuisance algal blooms apply to both free-floating phytoplankton and attached macrophytes. In the Bay, where nutrients are not limiting for algal growth, the biostimulatory substance could be sunlight, in which case the project activity that could potentially promote aquatic growth is localized reduction in suspended load outside a breached levee due to a net loss of suspended load inside the accreting marsh area.

The key indicator that a threshold of significant impact has been exceeded is if algal growths cause nuisance or adversely affect beneficial uses. A key difference between the regional setting (the Bay) and the Phase 2 project setting (managed ponds and restored tidal wetlands) is the baseline with respect to nuisance and protection of beneficial uses. In the regional setting, baseline levels of chlorophyll-a and the expected seasonal variations are well known because of regional monitoring programs. Likewise, dissolved oxygen levels in the regional setting typically meet the Basin Plan water quality objective of

5 mg/L. In contrast, the Bay fringe areas (i.e., former salt ponds, tidal marshes, and sloughs) that make up much of the project setting are known to have higher algal productivity and lower dissolved oxygen levels than in the open Bay. High algal productivity and lower dissolved oxygen levels are common to ponds, wetlands, and sloughs, and do not necessarily indicate degraded or impaired habitat.

Project activities that lead to unacceptable increases in algal composition would be deemed to have significant impacts if the SFRWQCB narrative water quality objective for population and community ecology is violated:

> All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce significant alterations in population or community ecology or receiving water biota. In addition, the health and life history characteristics of aquatic organisms in waters affected by controllable water quality factors shall not differ substantially from those for the same waters in areas unaffected by controllable water quality factors.

The narrative objective is helpful because it recognizes the interactive effect of toxicants on changes in community structure. For example, some species of algae (e.g., diatoms) are more resistant to free ionic copper than others (e.g., blue-green algae), and this difference can exert a significant effect on algal community structure. Establishing the narrative objective as a threshold ensures that adaptive management actions would address the interactive effects of biostimulation and other controllable water quality factors that can alter algal composition. The complexity of defining thresholds and baselines for algal abundance and composition is one reason this issue is being handled as a staircase issue. The narrative objectives cited above are sufficient as thresholds for the purposes of this analysis.

Threshold for Localized, Seasonal Low Dissolved Oxygen Levels

The threshold for low dissolved oxygen levels is established by the Basin Plan water quality objective for dissolved oxygen (see Table 3.3-1). Low dissolved oxygen levels can cause mortality in aquatic and benthic organisms (Impact 3.3-2, below), increased mercury methylation rates (Impact 3.3-3, below), and increased rates of disease such as avian botulism. In the Bay, low dissolved oxygen levels correspond to 5 mg/L dissolved oxygen or less for tidal waters, although the objective acknowledges that attaining 80 percent oxygen saturation as a 3-month median is satisfactory for protection of beneficial uses. In the Phase 2 project setting (managed ponds and restored tidal wetlands), the threshold for significance would vary depending on the habitat type. For open, fully tidal waters, the threshold is the same as for the regional setting—dissolved oxygen levels greater than 5 mg/L or at least 80 percent saturation as a 3-month median. But waters that are subject to muted or constrained tidal action (e.g., the managed ponds) function differently because they are managed primarily for wildlife habitat (avian species use). Restricted circulation often results in low dissolved oxygen levels. Therefore, for this analysis, low dissolved oxygen levels alone are not considered a threshold for managed ponds. Rather, the threshold for significant impacts is low dissolved oxygen levels and at least one of the following negative impacts of low dissolved oxygen: mortality of aquatic or benthic organisms, odors that cause nuisance, degraded habitat, or unacceptably high methylmercury production rates (see discussion of methylmercury, below).

This impact is also considered a staircase issue. To avoid exceeding thresholds of significant impact, the AMP defines triggers and associated adaptive management actions to prevent an impact from occurring.

Increased Methylmercury Production, Bioaccumulation, and Mobilization and Transport of Mercury-Contaminated Sediments

The project would have significant impacts to both the regional setting and the project setting if project actions resulted in water quality conditions that exceed the tissue-based mercury water quality objectives in the Basin Plan, as summarized in Table 3.3-4. The Bay Mercury TMDL also discusses a bird egg monitoring target that is also considered during evaluation of impacts. The bird egg monitoring target is a concentration of less than 0.5 mg/kg mercury for bird eggs (wet weight). This concentration is the lowest observable effect level for reproductive impairment in the endangered least tern. For Pond A8 studies a toxicity threshold of 0.9 mg/kg mercury fww (fresh wet-weight) for bird eggs has also been established for Forster's terms, which are present in the project area (Ackerman and Eagles-Smith 2008). In addition, the narrative water quality objective for bioaccumulation is considered to be a threshold for significant impacts:

> Many pollutants can accumulate on particles, in sediment, or bioaccumulate in fish and other aquatic organisms. Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life. Effects on aquatic organisms, wildlife, and human health will be considered.

Establishing this narrative objective as a threshold of significant impact clarifies that the main concern over mercury is methylmercury, because methylmercury is the primary mercury form that bioaccumulates.

In the regional setting, the threshold for significant impacts for total mercury concentrations in sediments is based, in part, on the suspended sediment mercury target established in the Bay mercury TMDL. The TMDL includes a target for mercury in suspended sediments of 0.2 mg/kg, computed as an annual median. It is important to recognize that the Bay is currently over this target, which is in part why a TMDL for mercury is being implemented. Project activities that release sediments to the Bay with a median mercury concentration exceeding ambient conditions (and this target value) would be deemed to have significant impacts. The threshold for impacts to managed ponds and restored tidal wetlands for total mercury in sediments is based on the ER-M for mercury (0.7 mg/kg), from the LTMS Guidelines for the beneficial re-use of dredged and sediments (see Table 3.3-5). Project activities that would result in sediments within the SBSP Restoration Project area that exceed this guideline would be deemed to have significant impacts. Low oxygen conditions are known to increase the risk of methylmercury production. Therefore, more sensitive thresholds for mercury concentrations in sediment could be considered for areas prone to low dissolved oxygen levels to stay below the threshold defined by the narrative objective for bioaccumulation.

Methylmercury bioaccumulation is identified as a staircase issue. The AMP is framed to avoid exceedance of thresholds by developing triggers for adaptive management actions. Triggers are based on methylmercury concentrations in water and sediments, net methylmercury production rates, and mercury concentrations in sentinel species in comparison to levels prior to restoration. Site-specific food web modeling and other tools have also been developed as part of the AMP. Because of the complexity of the biogeochemical processes affecting the conversion of mercury to methylmercury and its accumulation in the food chain, the impacts of mercury mobilization and transport and increased methylmercury production and bioaccumulation are addressed by the AMP.

Mobilization and Transport of Other Contaminants

For all other contaminants, the thresholds for significant impacts are the water quality objectives for the Bay established in the Basin Plan. Project activities that would cause an exceedance of these water quality objectives are deemed to have significant impacts. For pollutants of concern in sediments, the LTMS Sediment Guidance (Table 3.3-5) is also considered. A project activity would be considered to have significant impacts if it causes a detrimental increase in constituent concentrations above ambient conditions or above the ER-M. Some metals, such as nickel, have concentrations that are naturally higher than the ER-M.

Groundwater Quality

The threshold for an impact to groundwater quality is a substantial increase in the potential for salinity intrusion from the Bay into deep potable aquifers. This increase would be indicated by a project-related increase in salinity or total dissolved solids (TDS) at monitoring wells protecting water supplies that exceeds the narrative objective for salinity or the numeric objective for TDS or violates the state’s anti-degradation policy by unreasonably degrading the quality of high-quality water. The water quality objective for TDS in municipal water supplies is 500 mg/L.

Program-Level Evaluation Summary

The determination was made in the 2007 EIS/R that Programmatic Alternative A (the No Action Alternative) would result in a potentially significant impact and that both Action Alternatives would result in a less-than-significant impact for the following metrics:

- Changes in algal abundance and composition, which could in turn degrade water quality by lowering dissolved oxygen and/or promoting the growth of nuisance species;
- Potential to cause localized, seasonally low dissolved oxygen levels as a result of algal blooms, increased microbial activity, or increased residence time of water;
- Potential to mobilize, transport, and deposit mercury-contaminated sediments, leading to exceedance of numeric water quality objectives, TMDL allocations, and sediment quality guidelines for total mercury; and
- Potential increase in net methylmercury production and bioaccumulation in the food web.

The potential to cause seawater intrusion of regional groundwater sources was also considered potentially significant under No Action conditions, but less than significant in the Action Alternatives, one of which was selected for program-level implementation.

Under Programmatic Alternative A, it was determined that the lack of monitoring triggers and commitments to take adaptive management actions could lead to potentially significant changes in water quality. Under Programmatic Alternatives B and C, the conceptual designs of the overall alternatives in addition to the implementation of the AMP would reduce uncertainties, adverse water quality conditions, and adverse conditions associated with unintentional levee breaches. At the program level, the decision was made to select Programmatic Alternative C and implement Phase 1 actions.

Project-Level Evaluation

Phase 2 Impact 3.3-1: Degradation of water quality due to changes in algal abundance or composition.

Eutrophication, the process in which water bodies receive excess nutrients that stimulate excessive plant growth, is a potential concern in both the regional setting (the Bay) and the Phase 2 project settings (managed ponds and restored tidal wetlands). The conceptual model for coastal eutrophication emphasizes both direct and indirect factors that lead to changes in algal abundance and composition. These factors include water transparency, distribution and abundance of larger plants, nutrient ratios and their effect on algal assemblages, chemical transformations in sediment, the life cycle of bottom-dwelling and free-swimming invertebrates, and responses to toxic pollutants and other stressors (Cloern 2001). The reason for concern over increases in and changes to algal communities is the potential to impair the beneficial uses of water in the SBSP Restoration Project area and in the Bay. Changes to algal abundance and composition could cause nuisances and harm in aquatic ecosystems, including the red tides caused by dinoflagellates; paralytic shellfish poisoning caused by diatoms; and mats of blue-green algae that are unsightly, cause odors, and lead to depressed dissolved oxygen levels when they decay. Excess nutrients are an emerging water quality issue in San Francisco Bay, but it difficult is to predict specific ecosystem responses to increased nutrient loading. In general, however, tidal marshes and transition zones can uptake nutrients at a high rate and help ameliorate that potential issue.

The potential for changes in algal abundance and composition depends on a number of factors, including:

- Availability of limiting nutrients. The additional input of nutrients that otherwise limit algae production can stimulate algal growth, although there are other attenuating factors.
- Water transparency. Increased water transparency can stimulate plankton growth where light is the limiting factor, rather than nutrients. Bay waters are generally light limited, however, the limiting factor within restored tidal wetlands and managed ponds is not known.
- Hydraulic residence time. Within a managed pond or tidal marsh, the growth of free-floating algae is balanced by removal due to seasonal releases, for ponds, or tidal flushing, for marshes.
- Composition of zooplankton grazers. The amount of grazing organisms present and their food preference exerts a direct effect on algal community structure.
- Concentrations of biologically available metals that are toxic to algae. Different species of algae have different tolerances for metal toxins, such as copper. Metal toxicity is regulated by the amount of metal available for uptake by algae.

Each of these direct factors is dependent on a number of indirect factors. For example, nutrient concentrations are affected by both external sources and internal cycling at the sediment-water interface. Hydraulic residence time can change as water depths drop because of increased pond bottom elevations due to accretion. Water transparency decreases as suspended sediment increases, so wind shelter that creates quiescent areas can lead to increased light penetration inside restored tidal wetlands and managed ponds. Accretional areas that trap sediments within the ponds can decrease turbidity in areas adjacent to breached levees. Light penetration can be decreased by algal blooms, especially macrophytic algae. The composition of zooplankton grazer populations responds to changes both in the available food and the intensity of predation from higher organisms. The amount of biologically available metals, such as copper, present in the water column can shift in response to not only changes in metal concentrations but also the amounts of complexing agents present (e.g., dissolved organic matter) that reduce metal availability for uptake by algae. The intricacy of interactive effects between direct and indirect factors makes prediction of the exact response to project alternatives difficult, which is why effects are managed adaptively.

The AMP would address the uncertainties regarding the relationship between project activities and thresholds for significant impacts to algal abundance and composition by monitoring chlorophyll, growth rates, species composition, benthic habitat quality, benthic invertebrate communities, and sediment dissolved oxygen and oxidation-reduction (redox) profiles, as appropriate and necessary. Should project activities cause adverse changes to water quality, adaptive management measures would be implemented to reduce potential impacts (e.g., manipulating hydraulic residence time or altering the depths of managed ponds and restored tidal marshes).

The baseline conditions are different for the analysis in this Final EIR/S than in the 2007 EIR/S. In the 2007 EIR/S, the Programmatic No Action Alternative assumed not doing the program-level project also meant that the AMP would not be implemented. A program-level Action Alternative (Alternative C) was selected and is being implemented; that alternative included the AMP. Therefore, for the purposes of this analysis, the assumption now is that the landowners will continue to implement the AMP measures that maintain water quality. For this reason, some of the Phase 2 project-level significance determinations for the No Action Alternatives are different in this Final EIR/S analysis than in the 2007 EIR/S.

Alviso-Island Ponds

Alternative Island A (No Action). Under Alternative Island A (the No Action Alternative), existing breaches would continue to allow tidal inundation at the Island Ponds. Continued restoration of tidal marsh habitat would import sediment from tidal waters and continue to raise pond bottom elevations. Tidal flows would bring slough water through the breaches, where suspended sediments would settle out from the water before ebb flows. Accretion in the tidal marsh would decrease suspended sediment supply in the surrounding sloughs and open waters of the Bay, potentially resulting in increased light penetration and algal abundance outside of the ponds.

High-risk factors within any particular pond complex are waters that are deep, slow, rich in nutrients and chlorophyll, subject to calm wind exposure, and highly transparent. Conversely, the lowest-risk waterbodies would likely be shallow, quickly turned over, poor in nutrients and chlorophyll, windy and opaque. Fully tidal systems (both tidal ponds and adjacent sloughs) have short retentions times, are well mixed by tidal flows, and are often subject to wind and wave action. Therefore, the risk factors are relatively low and potential changes in algal abundance are likely to be minimal.

Adaptive management would also be used to address adverse changes in the abundance and composition of algal species. If triggers are exceeded as a result of high-risk factors, then adaptive management actions would be implemented that convert high-risk factors to low-risk factors. Examples of such actions may include making water shallower with fill, decreasing hydraulic residence times, or increasing exposure to wind. Because of monitoring and implementation of adaptive management measures, impacts would be less than significant.

Alternative Island A Level of Significance: Less than Significant

Alternative Island B. Under Alternative Island B, the Island Pond levees would be lowered or removed and Pond A19's northern levee would be breached to Mud Slough. This action would increase tidal flows in Mud Slough, which would scour the slough, causing it to deepen and widen. Areas near the new levee breaches would have increased accretion (e.g., in the northern portion of Pond A19). Sediment accreted in the tidal marsh would decrease suspended sediment supply in sloughs, potentially resulting in increased light penetration and algal abundance. Fully tidal systems (both tidal ponds and sloughs) have relatively short retentions times, are well mixed by tidal flows, and are often subject to wind and wave action. Therefore, the risk factors are low and potential changes in algal abundance are likely to be minimal. Furthermore, monitoring and implementation of adaptive management measures would be used to address harmful changes in the abundance and composition of algal species. Therefore, impacts would be less than significant.

Alternative Island B Level of Significance: Less than Significant

Alternative Island C. Under Alternative Island C, levees would be lowered or removed, all three ponds would be breached to Mud Slough, existing levee breaches would be widened, and existing channels inside Pond A19 would be extended to enhance delivery of sediment to the interior of the pond. Potential impacts from Alternative Island C would be similar to the impacts from Alternative Island B. The risk factors are low, and potential changes in algal abundance are likely to be minimal. Furthermore, monitoring and implementation of adaptive management measures would be used to address harmful changes in the abundance and composition of algal species. Therefore, impacts would be less than significant.

Alternative Island C Level of Significance: Less than Significant

Alviso-Mountain View Ponds

Alternative Mountain View A (No Action). Under Alternative Mountain View A (the No Action Alternative), no new activities would be implemented as part of Phase 2. The pond cluster would continue to be managed through the activities described in the AMP, in accordance with current USFWS practices. The Mountain View Ponds are currently operated for limited directional circulation through Ponds A1 and A2W, while maintaining discharge salinities to the Bay at less than 40 ppt. The current use of water in Charleston Slough to supply water to Shoreline Park's sailing lake would also continue.

Accretion rates within the ponds would be minor due to the limited directional circulation, and therefore changes in turbidity levels in adjacent sloughs due to pond operations would also be minor. Although the ponds are relatively deep and subsided, the summer hydraulic residence time within the Ponds A1 and A2W system is estimated to be 12 days (SFRWQCB 2008), which is shorter than larger pond systems in unaltered portions of the Alviso pond complex but much longer than fully tidal systems. Therefore, the risk factors are moderate, and potential changes in algal abundance would not be expected to be substantial. Furthermore, monitoring and implementation of adaptive management measures would be used to address harmful changes in the abundance and composition of algal species. Therefore, impacts would be less than significant.

Alternative Mountain View A Level of Significance: Less than Significant

Alternative Mountain View B. Alternative Mountain View B would increase tidal flows in Ponds A1 and A2W by breaching levees at several locations in Pond A2W and at one location in Pond A1. The breaches in Pond A2W to Whisman Slough would be armored and bridged for Pacific Gas and Electric Company (PG&E) access along the levee and out to the Bay-side levee of this pond. Levee breaches would allow full tidal inundation to the ponds, increasing tidal flows and scour in adjacent sloughs and increasing accretion rates within the ponds. Fully tidal systems (both tidal ponds and adjacent sloughs) have short retentions times, are well mixed by tidal flows, and are often subject to wind and wave action. Therefore, the risk factors are relatively low and changes in algal abundance would likely be minimal. Furthermore, monitoring and implementation of adaptive management measures would be used to address harmful changes in the abundance and composition of algal species. Therefore, impacts would be less than significant.

Alternative Mountain View B Level of Significance: Less than Significant

Alternative Mountain View C. Alternative Mountain View C would breach levees and lower levee heights to increase tidal flows in Pond A1, Pond A2W, and Charleston Slough. Pond A1 would be breached at three locations, Pond A2W would be breached at four locations, and the existing levee across Charleston Slough would also be breached or have its tide gates removed. The primary water intake for Shoreline Park's sailing lake would be relocated into the breach between Charleston Slough and Pond A1. Similar to the effects described for Alternative Mountain View B, these Phase 2 actions would allow full tidal inundation to the ponds, increasing tidal flows and scour in adjacent sloughs and increasing accretion rates within the ponds. Full tidal inundation would also occur at Charleston Slough, increasing mixing and decreasing residence time. Fully tidal systems (both tidal ponds and adjacent sloughs) have short retentions times, are well mixed by tidal flows, and are often subject to wind and wave action. Therefore, the risk factors are relatively low and changes in algal abundance would likely be minimal. Furthermore, monitoring and implementation of adaptive management measures would be used to address harmful changes in the abundance and composition of algal species. Therefore, impacts would be less than significant.

Alternative Mountain View C Level of Significance: Less than Significant

Alviso-A8 Ponds

Alternative A8 A (No Action). Under Alternative A8 A (the No Action Alternative), USFWS would continue to operate and maintain the A8 Ponds in accordance with the AMP and other ongoing management practices that have been in place since the implementation of the Phase 1 actions. The A8 Ponds would continue to have muted tidal exchange with Ponds A5 and A7 and also with Guadalupe Slough through the Pond A8 notch. Water exchange would be limited and managed, and the tidal range within the ponds would be muted during the dry summer and fall months. Even with the fully open notch, water level fluctuations in the ponds are small relative to fully tidal habitats; over a tidal cycle, water levels in Ponds A5, A7, and A8 would vary by approximately 0.5 foot compared to the greater than 8-foot tide range in Alviso Slough (SFRWQCB 2008). Nonetheless, this muted tidal exchange would facilitate mixing and reduce residence times, similar to exchange through other water control structures. Therefore, the risk factors are moderate and potential changes in algal abundance would not be expected to be substantial. Furthermore, monitoring and implementation of adaptive management measures would be used to address harmful changes in the abundance and composition of algal species. Therefore, impacts would be less than significant.

Alternative A8 A Level of Significance: Less than Significant

Alternative A8 B. Under Alternative A8 B, habitat transition zones would be constructed in Pond A8S's southwest and southeast corners. The Phase 2 actions would not change water levels in the A8 Ponds or interfere with water circulation. Potential effects to changes in the abundance and composition of algal species would be similar to those discussed under Alternative A8 A. Impacts would be less than significant.

Alternative A8 B Level of Significance: Less than Significant

Ravenswood Ponds

Alternative Ravenswood A (No Action). Under Alternative Ravenswood A (the No Action Alternative), no new activities would be implemented as part of Phase 2. Ponds R3, R4 and R5/S5 would continue to function as seasonal ponds. Seasonal ponds are passively managed; they receive direct precipitation, groundwater inflows, and minimal overland runoff during the wet season. During the dry season, seasonal ponds are allowed to dry out by seepage and evaporation. Although conditions within the ponds would be shallow and warm with high salinity and low dissolved oxygen levels, there would be very limited exchange (if any) with adjacent sloughs or the Bay. Therefore, effects to the abundance and composition of algal species in areas outside of the pond would be minimal and impacts would be less than significant.

Alternative Ravenswood A Level of Significance: Less than Significant

Alternative Ravenswood B. Under Alternative Ravenswood B, Pond R4 would be breached to Ravenswood Slough to allow full tidal inundation, Pond R3 would remain a seasonal pond, but a water control structure would be added to connect it to Ravenswood Slough to allow occasional, managed inflow to the borrow ditches and historic slough traces, which would improve forage habitat for western snowy plover. Ponds R5 and S5 would be converted from seasonal ponds to managed ponds through the construction of water control structures and some earthmoving. Pond R4 and portions of Ravenswood Slough would experience increased tidal flows. Fully tidal systems (both tidal ponds and sloughs) have short retentions times, are well mixed by tidal flows, and are often subject to wind and wave action. Therefore, the risk factors are relatively low and potential changes in algal abundance would be minimal. Pond R3 would continue to have very limited exchange (if any) with Ravenswood Slough and would not cause substantial changes to algae in the slough.

Ponds R5 and S5 would be converted to managed ponds, which would have managed exchange with Flood Slough and Pond R4. If not well managed, these ponds could become stagnant and rich in nutrients, and therefore would have higher risk factors for changes to algal abundance. However, water control structures connecting Ponds R5 and S5 with Pond R4 and Flood Slough, respectively, would allow directional circulation and other management activities to minimize adverse effects. Should managed ponds cause adverse changes to algal abundance and composition, adaptive management measures would be implemented to reduce potential impacts (e.g., manipulating hydraulic residence time or altering the depths of the managed ponds). Because adaptive management would be used to minimize adverse effects from managed ponds, impacts would be less than significant.

Alternative Ravenswood B Level of Significance: Less than Significant

Alternative Ravenswood C. Alternative Ravenswood C would have similar effects to those described for Alternative Ravenswood B, with the following exceptions: Pond R4 would also be breached to the channel between it and Greco Island, Ponds R5 and S5 would be converted and managed to simulate an intertidal mudflat, and water control structures would be installed on Pond R3 to allow occasional managed inflow to the borrow ditches and historic slough traces, which would improve forage habitat for western snowy plover.

Pond R4 and portions of Ravenswood Slough and the channel near Greco Island would experience increased tidal flows and have short retentions times. Therefore, the risk factors are relatively low and potential changes in algal abundance would be minimal.

Ponds R3, R5, and S5 would have limited exchange with Ravenswood Slough, Flood Slough, or Pond R4 through water control structures. The water control structure connecting Pond R3 to Ravenswood Slough would be opened during the incoming tide to reduce potential discharges. The water control structures between Flood Slough and Pond S5 and between Pond R5 and Pond R4 would be operated to provide directional circulation. If not well managed, water in Ponds R5 and S5 could become stagnant and rich in nutrients, and therefore these ponds have higher risk factors for changes to algal abundance. However, the water control structures and the simulation of daily tidal cycles would reduce this risk. (Risks for adverse changes in algal abundance in managed mudflats would be lower than for other types of managed ponds, but greater than for fully tidal systems.) Should these ponds cause adverse changes to algal abundance and composition, adaptive management measures would be implemented to reduce potential impacts (e.g., manipulating hydraulic residence time or altering the depths of the managed ponds). Because adaptive management would be used to minimize adverse effects from managed ponds, impacts would be less than significant.

Alternative Ravenswood C Level of Significance: Less than Significant

Alternative Ravenswood D. Alternative Ravenswood D would open Pond R4 to tidal flows, install water control structures on Pond R3, remove levees within and between Ponds R5 and S5, convert Ponds R5 and S5 to enhanced managed ponds, and allow stormwater outflow from the Bayfront Canal and Atherton Channel to flow into Ponds R5 and S5.

Similar to the effects described above for Alternative Ravenswood B, tidal flows in Pond R4 and portions of Ravenswood Slough would allow tidal mixing with short retention times. Therefore, the risk factors are relatively low and potential changes in algal abundance would likely be minimal.

Ponds R3, R5, and S5 would have limited exchange with Ravenswood Slough, Flood Slough, and Pond R4 through water control structures. The water control structure connecting Pond R3 to Ravenswood Slough would be opened only during the incoming tide to reduce potential discharges. The water control structures between Flood Slough and Pond S5 and between Pond R4 and Pond R5 could be operated to provide directional circulation. If not well managed, water in the managed ponds could become stagnant and rich in nutrients, and therefore there would have higher risk factors for changes to algal abundance. However, the water control structures and regular cycling of water through the ponds would minimize adverse effects. Stormwater inflow would increase circulation, but could also contribute additional nutrients. Should these ponds cause adverse changes to algal abundance and composition, adaptive management measures would be implemented to reduce potential impacts (e.g., manipulating hydraulic residence time or altering the depths of the managed ponds). Because adaptive management would be used to minimize adverse effects from managed ponds, impacts would be less than significant.

Alternative Ravenswood D Level of Significance: Less than Significant

Phase 2 Impact 3.3-2: Degradation of water quality due to low dissolved oxygen levels.

Dissolved oxygen in the water column is necessary to support respiring organisms. Dissolved oxygen is depleted in pond and marsh environments by respiration and chemical and microbial aerobic processes.

Dissolved oxygen is replenished in the system through photosynthesis and reaeration (i.e., oxygen transfer from the atmosphere). Changes in water flow, residence time, and algal abundance productivity (see Impact 3.3-1, above) could change dissolved oxygen levels in managed ponds, tidal marsh habitat, and discharges from project areas into the Bay. Potential impacts of low dissolved oxygen levels include depressed species diversity, fish kills, death of other aquatic organisms, and odor problems. Even short periods of depressed dissolved oxygen levels can lead to death of aquatic organisms. Another impact of low dissolved oxygen levels, discussed under Impact 3.3-3, below, is increased net methylmercury production.

Microbial degradation of organic matter in pond and marsh sediments can have significant oxygen demand. Death of algae and aquatic organisms contributes to the organic matter supply and oxygen demand is dependent on the amount of organic matter available to decay. Respiration may also be a significant oxygen demand if algae and organism populations are large. Algae are net oxygen consumers at night, when wind-driven reaeration is low. This creates periods of low dissolved oxygen levels. Dissolved oxygen is then replenished during the day when the algae photosynthesize instead of respiring and wind-driven reaeration increases. Reaeration rates are largely dependent on wind mixing and flow rates. Mixing brings low-dissolved-oxygen waters to the surface, driving oxygen transfer, and turbulence increases the surface area for oxygen transfer. Waters flowing slowly through a pond would not be as well mixed as faster-moving waters. Stagnant conditions can lead to anoxic waters if oxygen demands exceed reaeration.

Environments of varying dissolved oxygen ranges can support different communities. Tidal marshes and ponds designed for shorebird habitat may flourish under lower dissolved oxygen conditions than deeper-water communities. For this reason, the water quality standard for dissolved oxygen is thoughtfully applied to areas where the dissolved oxygen level is expected to be naturally low, such as slow-moving or standing water over vegetated areas or mudflats. Fringe areas of the Bay, particularly managed ponds, are expected to experience periodic declines in dissolved oxygen levels.

Alviso-Island Ponds

Alternative Island A (No Action). Under Alternative Island A (the No Action Alternative), existing breaches would continue to allow full tidal inundation at the Island Ponds. Tidal flows would bring Bay water through the breaches, where suspended sediments would settle out from the water before ebb flows. Fully tidal systems have relatively high reaeration rates because filling and draining of the ponds causes increased mixing and higher flow rates to the ponds and downstream sloughs, and because ponds are subject to wind mixing. Therefore, the risk of poor dissolved oxygen levels in breached ponds would be low and impacts would be less than significant.

Alternative Island A Level of Significance: Less than Significant

Alternative Island B. Under Alternative Island B, pond levees would be lowered or removed, and Pond A19's northern levee would be breached to Mud Slough. The Island Ponds would continue to have full tidal inundation and tidal flows in Mud Slough and circulation between Ponds A19 and A20 would increase. Fully tidal systems have relatively high reaeration rates because filling and draining of the ponds causes increased mixing and higher flow rates to the ponds and downstream sloughs, and because ponds are subject to wind mixing. Therefore, the risk of poor dissolved oxygen levels in breached ponds would be low and impacts would be less than significant.

Alternative Island B Level of Significance: Less than Significant

Alternative Island C. Under Alternative Island C, levees would be lowered or removed, all three ponds would be breached to Mud Slough, existing levee breaches would be widened, and existing channels inside Pond A19 would be extended to enhance delivery of sediment to the interior of the pond. The Island Ponds would continue to have full tidal inundation. Potential impacts from Alternative Island C would be similar to the impacts described in Alternative Island B. Therefore, the risk of poor dissolved oxygen levels in breached ponds would be low and impacts would be less than significant.

Alternative Island C Level of Significance: Less than Significant

Alviso-Mountain View Ponds

Alternative Mountain View A (No Action). Under Alternative Mountain View A (the No Action Alternative), Ponds A1 and A2W would continue to be operated with limited directional circulation. The current use of water in Charleston Slough to supply water to Shoreline Park's sailing lake would also continue.

Maintaining adequate dissolved oxygen levels in managed ponds of the Alviso pond complex has been the major water quality challenge. The SFRWQCB has recognized that it may not be feasible for a well-operated lagoon system to meet an instantaneous dissolved oxygen discharge limitation of 5.0 mg/L. Also, it has been noted that sloughs in the South Bay often do not meet the Basin Plan objective of 5.0 mg/L. For this reason, the project has been implementing adaptive management practices if dissolved oxygen levels fall below a 10th percentile of 3.3 mg/L (calculated on a weekly basis) at the point of discharge.[7] These values represent natural dissolved oxygen variations in sloughs or lagoon systems. Even using this trigger value as a threshold, corrective measures have been implemented repeatedly in the Alviso pond complex to address low dissolved oxygen levels in managed pond discharges, such as discharge timing, implementing muted tidal flows, and installing baffles (SFRWQCB 2008).

Adaptive management measures have been implemented in the Mountain View Ponds to address issues with low dissolved oxygen. The ponds are now operated under directional flow to maximize flow-through and reduce stagnant areas in the back portions of the ponds. Circulation can be further increased in the pond system by opening the inlet further, or if increased flows are not possible, fully opening the discharge gate to allow the pond to become a muted tidal system until pond dissolved oxygen levels revert to levels at or above conditions in the Bay or slough (USFWS and USGS 2012).

Under the No Action condition, similar adaptive management measures would be implemented during low dissolved oxygen conditions (e.g., changing residence times and/or water depths). Due to the limited tidal flushing with the current system, low dissolved oxygen levels still occur from time to time, a situation similar to the existing condition. Because this condition already exists, and the No Action Alternative at the Mountain View Ponds would not worsen that, there would be a less-than-significant impact.

Alternative Mountain View A Level of Significance: Less than Significant

Alternative Mountain View B. Alternative Mountain View B would increase tidal flows in Ponds A1 and A2W by breaching levees at several locations in Pond A2W and at one location in Pond A1. Levee

[7] This dissolved oxygen trigger was based on levels found in Artesian Slough near Heron Rookery in July 1997 (SFRWQCB 2008).

breaches would allow full tidal inundation to these ponds and increased tidal flows and scour in adjacent sloughs. After breaching Ponds A1 and A2W, the amount biological oxygen demand in ebb flows may temporarily increase; however, tidal currents would provide flushing flows and mixing to improve reaeration and dilute nutrients. Fully tidal systems have relatively high reaeration rates from the filling and draining of the ponds with the tide cycle and because the ponds are subject to wind mixing. Therefore, the risk of poor dissolved oxygen levels in breached ponds would be low and impacts would be less than significant.

Alternative Mountain View B Level of Significance: Less than Significant

Alternative Mountain View C. Alternative Mountain View C would breach levees and lower levee heights to increase tidal flows in Pond A1, Pond A2W, and Charleston Slough. Pond A1 would be breached at three locations, Pond A2W would be breached at four locations, and the existing levee across Charleston Slough would be breached or have its tide gates removed. These Phase 2 actions would allow full tidal inundation to Ponds A1 and A2W, increasing tidal flows and scour in adjacent sloughs. Charleston Slough would also become fully tidal.

Similar to the effects described for Alternative Mountain View B, the amount biological oxygen demand in ebb flows may temporarily increase after breaching the Mountain View Ponds; however, tidal currents would provide flushing flows and mixing to improve reaeration and dilute nutrients. Fully tidal systems have relatively high reaeration rates from the filling and draining of the ponds with the tide cycle, and because the ponds are subject to wind mixing. Shallow water environments, such as Charleston Slough, would allow dissolved oxygen from surface reaeration to rapidly become vertically well mixed. Therefore, the risk of poor dissolved oxygen levels in breached ponds would be low and impacts would be less than significant.

Alternative Mountain View C Level of Significance: Less than Significant

Alviso-A8 Ponds

Alternative: A8 A (No Action). Under Alternative A8 A (the No Action Alternative), the A8 ponds would continue to have muted tidal exchange with Ponds A5 and A7 and also with Guadalupe Slough through the Pond A8 notch. Water exchange would be limited and managed, and the tidal range within the ponds would be muted during the dry summer and fall months.

During the 2011 monitoring season at Pond A8's discharge notch, daily average dissolved oxygen concentrations ranged from a low of 2.4 mg/L to a high of 14 mg/L. Daily average dissolved oxygen concentrations at Pond A8 rarely fell below the 3.3 mg/L adaptive management trigger; only once in late September and twice during late October did daily dissolved oxygen averages drop below that threshold (USFWS and USGS 2012).

Under the No Action conditions, adaptive management measures (e.g., changing residence times and/or water depths) would be implemented during low dissolved oxygen conditions to reduce the potential for adverse conditions associated with low dissolved oxygen levels, such as mortality of aquatic or benthic organisms, odors that cause nuisance, degraded habitat, or unacceptably high methylmercury production rates. Because of monitoring and implementation of adaptive management measures, impacts would be less than significant.

Alternative A8 A Level of Significance: Less than Significant

Alternative A8 B. Under Alternative A8 B, Phase 2 actions would not change water levels in the A8 Ponds or interfere with water circulation. Potential impacts from low dissolved oxygen levels would be similar to those discussed under Alternative A8 A. Adaptive management measures (e.g., changing residence times and/or water depths) would be implemented during low dissolved oxygen conditions to reduce the potential for adverse conditions associated with low dissolved oxygen levels, such as mortality of aquatic or benthic organisms, odors that cause nuisance, degraded habitat, or unacceptably high methylmercury production rates. Because of monitoring and implementation of adaptive management measures, impacts would be less than significant.

Alternative A8 B Level of Significance: Less than Significant

Ravenswood Ponds

Alternative Ravenswood A (No Action). Under Alternative Ravenswood A (the No Action Alternative), no new activities would be implemented as part of Phase 2 and Ponds R3, R4 and R5/S5 would continue to function as seasonal ponds. Dissolved oxygen concentrations within the ponds would likely be very low, but water would not be discharged from the ponds and any seepage from the ponds would be minimal. Therefore, there would be little to no effect to water quality in adjacent sloughs or open Bay waters and impacts would be less than significant.

Alternative Ravenswood A Level of Significance: Less than Significant

Alternative Ravenswood B. Under Alternative Ravenswood B, Pond R4 would be breached to Ravenswood Slough to allow full tidal inundation, and Pond R3 would remain a seasonal pond, but a water control structure would be installed on Pond R3 to allow inflow to improve forage habitat for western snowy plover. Ponds R5 and S5 would be converted from seasonal ponds to managed ponds through the construction of water control structures and some earthmoving.

Initial breaching of Pond R4 may temporarily increase the amount of biological oxygen demand in ebb flows, but tidal currents would also provide mixing, improve reaeration, and dilute nutrients, and the shallow water environment would allow dissolved oxygen from surface reaeration to rapidly become vertically well mixed. Pond R3 would continue to have very limited exchange (if any) with Ravenswood Slough. Ponds R5 and S5 would be converted to managed ponds that have limited exchange with Flood Slough and Pond R4. Depending on how the water control structures between Flood Slough and Pond S5 and between Pond R5 and Pond R4 are operated (i.e., opened for continuous directional flow or primarily closed to provide maximum water depth), the residence time in the ponds could be on the order of hours to days. If residence times are long, water in the managed ponds would likely be stagnant and rich in nutrients, particularly in summer months, and therefore dissolved oxygen concentrations may be low.

Adaptive management measures (e.g., changing residence times and/or water depths) would be implemented during low dissolved oxygen conditions to reduce the potential for adverse conditions associated with low dissolved oxygen levels, such as mortality of aquatic or benthic organisms, odors that cause nuisance, degraded habitat, or unacceptably high methylmercury production rates. Because of monitoring and implementation of adaptive management measures, impacts would be less than significant.

Alternative Ravenswood B Level of Significance: Less than Significant

Alternative Ravenswood C. Alternative Ravenswood C would have similar effects to those described for Alternative Ravenswood B, with the following exceptions: Pond R4 would also be breached to the channel between it and Greco Island, Ponds R5 and S5 would be converted to managed mudflats, and water control structures would be installed on Pond R3 to allow inflow to improve forage habitat for western snowy plover. The water control structures connecting Pond R3 to Ravenswood Slough would be opened only during the incoming tide to reduce potential discharges.

Ponds R5 and S5 would be managed ponds operated as mudflats that fill and drain with the tide cycle. These flows would provide mixing, improve reaeration, and dilute nutrients and the shallow water environment would also allow dissolved oxygen from surface reaeration to rapidly become vertically well mixed. The risk of poor dissolved oxygen levels in managed mudflats would be lower than in other types of managed ponds, but greater than in fully tidal systems. Therefore, the potential for poor dissolved oxygen levels in Ponds R5 and S5 would be moderately low because of very low residence time.

Adaptive management measures (e.g., changing residence times and/or water depths) would be implemented during low dissolved oxygen conditions to reduce the potential for adverse conditions associated with low dissolved oxygen levels, such as mortality of aquatic or benthic organisms, odors that cause nuisance, degraded habitat, or unacceptably high methylmercury production rates. Because of monitoring and implementation of adaptive management measures, impacts would be less than significant.

Alternative Ravenswood C Level of Significance: Less than Significant

Alternative Ravenswood D. Alternative Ravenswood D would open Pond R4 to tidal flows, remove levees within and between Ponds R5 and S5, convert Ponds R5 and S5 to enhanced managed ponds, allow stormwater outflow from the Bayfront Canal and Atherton Channel (which carries stormwater from portions of Redwood City, Menlo Park, Atherton, and unincorporated San Mateo County) to flow into Ponds R5 and S5, and install water control structures on Pond R3. The structure connecting Pond R3 to Ravenswood Slough would be opened only during the incoming tide to reduce potential discharges.

Alternative Ravenswood D would have similar effects to those described for Alternative Ravenswood B, with the exception that stormwater inflow would increase circulation during and shortly after heavy rains, but may also contribute additional nutrients. The contribution from stormwater inflow would occur only during winter storms. Depending on how the water control structures are operated (i.e., opened for continuous directional flow or primarily closed to provide maximum water depth), the residence time in the ponds could be on the order of hours to days. If residence times are long, water in the managed ponds would likely be stagnant and rich in nutrients, particularly in summer months, and therefore dissolved oxygen concentrations may be low.

Adaptive management measures (e.g., changing residence times and/or water depths) would be implemented during low dissolved oxygen conditions to reduce the potential for adverse conditions associated with low dissolved oxygen levels, such as mortality of aquatic or benthic organisms, odors that cause nuisance, degraded habitat, or unacceptably high methylmercury production rates. Because of monitoring and implementation of adaptive management measures, impacts would be less than significant.

Alternative Ravenswood D Level of Significance: Less than Significant

Phase 2 Impact 3.3-3: Degradation of water quality due to increased methylmercury production or mobilization of mercury-contaminated sediments.

A major concern with mercury pollution in the Bay is the accumulation of methylmercury in biota, particularly at the top of aquatic food webs. Mercury occurs in many forms, but methylmercury is the form that poses the highest bioaccumulation risk. Methylmercury is converted from inorganic mercury primarily by the metabolic activity of bacteria, especially sulfate-reducing bacteria. Because microbial activity is generally increased in productive wetlands and marshes, restoration of tidal marshes has the potential to increase net production of methylmercury.

The linkage between inorganic mercury and methylmercury is complex. Clearly, when no inorganic mercury is present, no methylmercury can be formed. Increased inorganic mercury concentrations in sediments are known to drive increased methylmercury production when considering order-of-magnitude increases. For example, comparing ambient Bay sediments to mercury-contaminated sediments in the Guadalupe River watershed, the latter typically have higher methylmercury concentrations. However, for the range of inorganic mercury concentrations in sediments found within the SBSP Restoration Project area (from 0.1 to 4 ppm), the concentration of inorganic mercury did not have a significant correlation with the concentration of methylmercury.

This analysis of methylmercury impacts focuses on methylmercury in the food chain. The analysis recognizes the latest science supporting water quality standards and moves the evaluation closer to the actual beneficial uses of interest: making fish safe for people and wildlife to eat. Net methylation rates are emphasized because the overall release of methylmercury reflects the balance of production and degradation of methylmercury. Methylmercury can be degraded by sunlight and microbial activity. Dissolved oxygen and sulfide concentrations are examples of water quality factors that affect production of methylmercury. In contrast, microbial community composition (which is dependent on redox conditions) affects net methylmercury production by influencing both production and degradation.

Dissolved oxygen is a factor that can affect net methylmercury production. Sulfate-reducing bacteria that produce methylmercury are known to thrive under low-oxygen conditions. Low-oxygen conditions also promote the breakup of oxide surfaces on particles, which can release methylmercury into the water column. The introduction to Section 3.3.3, above, describes dissolved oxygen as a staircase water quality issue. One of the important points of that discussion is that low dissolved oxygen conditions do occur in wetland and marsh habitats. If low dissolved oxygen is found to drive elevated net methylmercury production and bioaccumulation, this would be considered a significant impact.

There are other factors that affect net methylmercury production, including redox conditions, the chemical form of the inorganic mercury, and sulfate concentrations. Some forms of inorganic mercury are more readily available to methylating bacteria than other forms, particularly neutrally charged soluble sulfide complexes. The amount of available sulfide can, in turn, be affected by iron redox chemistry, which is strongly affected by the nature of vegetative root matter and sediment characteristics. These characteristics set up complex spatial variation in the chemical form of inorganic mercury, with unique pockets of localized methylmercury production rates. There also appears to be an optimum window of sulfate concentrations that maximizes net methylmercury production. Too little sulfate prevents sulfate-reducing bacteria from thriving and producing sulfide, and too much produces so much sulfide that the availability of inorganic mercury is diminished (Benoit et al. 1998; Gilmour et al. 1992; Gilmour et al. 1998). Creation of estuarine microzones in a particular window of sulfate concentrations could enhance methylmercury production.

The ecological endpoint evaluated is methylmercury in the food web. Most of the foregoing discussion has been focused on net methylmercury production rates, because net methylmercury production is an important factor affecting methylmercury bioaccumulation. But the structure of the food web also is an important control on methylmercury bioaccumulation. Methylmercury bioaccumulation increases at increasing trophic levels and with increasing food web complexity. These characteristics are driven by the biomagnification of methylmercury. Methylmercury binds strongly to protein residues. Large organisms eat smaller organisms for their protein, and so retain the associated methylmercury. With every step up the food chain, mercury concentrations are found to increase, which is why large predators such as leopard sharks and striped bass have higher mercury concentrations than smaller fish like surf perch. Increasing food web complexity can also increase mercury concentrations at the top of the food web. Adding links to the food web increases the overall biomagnification of methylmercury for top-level predators. Therefore, project activities that alter ecosystem structure could affect mercury accumulation.

Factors that add to risk of increased net mercury methylation include mercury-contaminated sediments; low dissolved oxygen levels, which promote methylating bacteria and/or the breakup of oxide surfaces; water quality factors that increase mercury bioavailability to methylating bacteria; and factors that reduce the activity of demethylating bacteria and photodemethylation. Factors that increase the risk of bioaccumulation include increased food web complexity, longer-lived prey items, and shifting foraging habits of predators. Effects are complex and difficult to predict, which is why methylmercury bioaccumulation impacts would be adaptively managed.

The impact analysis also focuses on the water quality and sediment quality impacts of inorganic mercury and so considers movement and transport of total mercury along with other water quality factors that affect net methylmercury production and bioaccumulation. The Basin Plan establishes a target concentration for mercury in suspended sediment of 0.2 mg/kg mercury in dry sediment, to help support the human health and wildlife fish tissue and water quality criteria (see Table 3.3-4). Mobilization and transport of mercury-contaminated sediments into and out of the project area could cause exceedance of numeric water quality criteria or sediment quality guidelines.

The geography and history of the Bay affects the distribution of mercury-contaminated sediments within and surrounding the project area. The South Bay has been subjected to discharges of mercury-contaminated sediments originating from the historic New Almaden mining district. The mining activities causing these discharges date back to the late 1800s and early 1900s, although the discharges persist as a legacy source in the Guadalupe River watershed. The Guadalupe River Watershed Mercury TMDL is an effort to ensure that land in, around, and downstream of the New Almaden mines will be cleaned up and restored to beneficial use. However, a legacy of mercury contamination persists in the form of a north-south mercury concentration gradient in sediments in the lower South Bay (SFRWQCB 2006).

Activities that result in sediments in managed ponds and restored tidal wetlands having mercury concentrations exceeding the LTMS Guidelines (0.7 mg/kg) have the potential to cause impacts to the Bay. In this case, the potential impact is toxic effects on benthic communities, not bioaccumulation. Re-mobilization of mercury-contaminated sediments into the water column can lead to exceedance of suspended sediment targets for mercury because there is a direct relationship between the concentration of suspended sediments in the water column, the concentration of mercury on those suspended sediments, and the concentration of total mercury in the water column. Project activities could impact attainment of suspended sediment targets for mercury by changing ambient TSS or by changing the mercury concentration on suspended particles.

Alviso-Island Ponds

Alternative Island A (No Action). Under Alternative Island A (the No Action Alternative), existing breaches would continue to allow full tidal inundation at the Island Ponds. Continued restoration of tidal marsh habitat would import sediment from tidal waters and continue to raise pond bottom elevations. Sediment mercury concentrations in the Island Ponds are expected to be similar to concentrations found in the suspended sediments of the lower South Bay. Long-term mercury concentrations in sediment of the lower South Bay are greater than the target concentration of 0.2 mg/kg, but similar to other areas of the Bay. Sediment methylmercury concentrations in the lower South Bay are slightly elevated (see Section 3.3.1, Physical Setting). Mercury concentrations in the Bay and the Island Ponds would remain near ambient conditions and restoration of the tidal marshes would create accretional areas, resulting in a net loss of mercury from the Bay to the ponds. In addition, because continued full tidal flow in the Island Ponds would result short water residence times, methylation rates should remain low and impacts would be less than significant.

Alternative Island A Level of Significance: Less than Significant

Alternative Island B. Under Alternative Island B, pond levees would be lowered or removed and Pond A19's northern levee would be breached to Mud Slough. These actions would increase tidal flows in Mud Slough and increase circulation between Ponds A19 and A20. Sediment mercury concentrations in Mud Slough are expected to be similar to ambient conditions because the slough is not directly connected to the Guadalupe River watershed. Potential effects from mercury and methylmercury would be similar to those discussed under Alternative Island A. Mercury concentration in the Bay, sloughs, and Island Ponds are expected to remain near ambient conditions, and water residence times would be similar or shorter. Therefore, impacts would be less than significant.

Alternative Island B Level of Significance: Less than Significant

Alternative: Island C. Under Alternative Island C, levees would be lowered or removed, all three ponds would be breached to Mud Slough, existing levee breaches would be widened, and existing channels inside Pond A19 would be extended to enhance delivery of sediment to the interior of the pond. Sediment mercury concentrations in Mud Slough are expected to be similar to ambient conditions because the slough is not directly connected to the Guadalupe River watershed. Potential effects from mercury and methylmercury would be similar to those discussed under Alternative Island A. Mercury concentrations in the Bay, sloughs, and Island Ponds are expected to remain near ambient conditions and water residence times would be similar or shorter. Therefore, impacts would be less than significant.

Alternative Island C Level of Significance: Less than Significant

Alviso-Mountain View Ponds

Alternative Mountain View A (No Action). Under Alternative Mountain View A (the No Action Alternative), Ponds A1 and A2W would continue to be operated with limited directional circulation, and the current use of water in Charleston Slough to supply water to Shoreline Park's sailing lake would also continue. Sediment mercury concentrations in the Mountain View Ponds are expected to be similar to concentrations found in suspended sediments of the lower South Bay because the ponds do not have a direct connection to drainage from the Guadalupe River watershed. Long-term mercury concentrations in the sediment of the lower South Bay are greater than the target concentration of 0.2 mg/kg, but similar to other areas of the Bay. Sediment methylmercury concentrations are slightly elevated.

Managed ponds could have higher rates of net methylmercury production than fully tidal systems. The large pool of easily degraded organic matter in the managed pond (from algal production) could lead to higher methylmercury concentrations in sediment, water, and biota. Labile organic matter fuels the bacteria that methylate inorganic mercury. Ponds that experience very high rates of primary production would likely benefit (in terms of lowering current methylmercury concentrations) from tidal flushing (Grenier et al. 2010).

Adaptive management would be used to monitor effects from managed ponds. Adaptive management monitoring could include methylmercury concentrations in water and biota; special studies of methylmercury production, degradation, and transport; and changes in food web indicators and sentinel species. Adaptive management actions would be triggered when mercury concentrations of sentinel species increase substantially compared to nearby reference sites since mercury in biota can change year to year at a given site without any apparent change in management. If triggers are exceeded, then adaptive management actions would be implemented. Examples of such actions include changing hydraulic residence times or manipulating other factors depending on the specific case. Because adaptive management would be used to minimize adverse effects, impacts would be less than significant.

Alternative Mountain View A Level of Significance: Less than Significant

Alternative Mountain View B. Alternative Mountain View B would increase tidal flows in Ponds A1 and A2W by breaching levees at several locations in Pond A2W and at one location in Pond A1. Levee breaches would allow full tidal inundation to these ponds and increase tidal flows and scour in adjacent sloughs. Although wetting and drying cycles could enhance methylmercury production, the conversion of managed ponds to fully tidal marsh would likely lessen the risk of a mercury problem within the pond. The restored tidal marsh would produce less labile organic matter than what is produced in the managed pond, providing less fuel for methylating bacteria and leading to less methylmercury production. There is, however, a potential risk associated with the remobilization of mercury-laden sediment in sloughs downstream of breaches due to scour from the increased tidal prism following reconnection of ponds to full tidal flows. This scour could increase the amount of inorganic mercury that is available for methylmercury production and uptake into the food web, at least in the short term. However, the remobilized sediment would mix with other sediment, be dispersed by the tides, and proceed through various fates of deposition, burial, or further transport (Grenier et al. 2010). Restoration of the tidal marshes would create accretional areas, eventually resulting in a net loss of mercury from the Bay to the ponds.

Adaptive management would be used to monitor effects from tidal marsh restoration. Adaptive management monitoring could include methylmercury concentrations in water and biota; special studies of methylmercury production, degradation, and transport; and changes in food web indicators and sentinel species. Adaptive management actions would be triggered when mercury concentrations of sentinel species increase substantially, regardless of whether they are over or under desirable levels. If triggers are exceeded, then adaptive management actions would be implemented to avoid significant impacts. Examples of such actions include capping with clean fill; removing mercury-contaminated sediments; or manipulating other factors such as encouraging development of favorable plant species. Because adaptive management would be used to minimize adverse effects, impacts would be less than significant.

Alternative Mountain View B Level of Significance: Less than Significant

Alternative Mountain View C. Alternative Mountain View C would breach levees and lower levee heights to increase tidal flows in Pond A1, Pond A2W, and Charleston Slough. Pond A1 would be breached at three locations, Pond A2W would be breached at four locations, and the existing levee across Charleston Slough would be breached or have its tide gates removed. These Phase 2 actions would allow full tidal inundation to Ponds A1 and A2W, increasing tidal flows and scour in adjacent sloughs. Charleston Slough would also become fully tidal.

Potential effects from mercury and methylmercury would be similar to those discussed under Alternative Mountain View B. The conversion of managed ponds to fully tidal marsh would likely lessen the risk of a mercury problem within the pond and although there would likely be short-term increases in transport of mercury-contaminated sediments, restoration of the tidal marshes would create accretional areas, eventually resulting in a net loss of mercury from the Bay to the ponds. Adaptive management would be used to monitor effects from tidal marsh restoration. Because adaptive management would be used to minimize adverse effects, impacts would be less than significant.

Alternative Mountain View C Level of Significance: Less than Significant

Alviso-A8 Ponds

Alternative A8 A (No Action). Under Alternative A8 A (the No Action Alternative), the A8 Ponds would continue to have muted tidal exchange with Ponds A5 and A7 and also with Guadalupe Slough through the Pond A8 notch. Water exchange would be limited and managed, and the tidal range within the ponds would be muted during the dry summer and fall months.

Ponds in the Alviso pond complex along Alviso Slough, including the A8 Ponds, have elevated mercury concentrations in sediments due to deposition of mercury-laden sediments from the Guadalupe River watershed. Mercury-enriched sediment is mobilized in the upper watershed during storms and tidally mixed with ambient sediments in Alviso Slough and bayward channels. Bioavailability and bioaccumulation of mercury were found to be greater in Pond A8 than in either Alviso Slough or its fringing tidal marsh. Methylmercury concentrations in water and sediment were greater in Pond A8 than in Alviso Slough or its fringing tidal marsh channels, and biosentinels representing benthic and shoreline habitats indicated more mercury bioaccumulation in Pond A8 than in the tidal marshes along Alviso Slough (Grenier et al. 2010). As discussed above, extensive monitoring of mercury bioaccumulation in response to operational actions at Pond A8 has been ongoing.

The large pool of easily degraded organic matter (from algal production) in Pond A8 is most likely the driving force that leads to higher methylmercury concentrations in Pond A8 sediment, water, and biota. In contrast, the organic matter associated with Alviso Slough and the fringing marsh is largely terrestrial in nature and much less easily degraded by bacteria, presumably leading to overall lower rates of microbial activity and methylmercury production. There are also layers of sediment with relatively high concentrations of total mercury buried beneath Alviso Slough that could be exhumed by tidal scour. This scour could increase the amount of inorganic mercury that is available for methylmercury production and uptake into the food web, at least in the short term within Alviso Slough and Pond A8. Remobilized sediment would mix with other sediment; be dispersed by the tides; and proceed through various fates of deposition, burial, or further transport (Grenier et al. 2010). The Pond A8 actions are not expected to result in mobilization of mercury because the mercury concentrations in the upland fill that that would be placed above the tidal zone would be screened to ensure that the fill meets guidelines for reuse. In addition, the fill to be placed would likely cover older sediment with higher concentrations of mercury.

Adaptive management measures have been and will continue to be used to monitor effects from the A8 Ponds. Adaptive management monitoring could include methylmercury concentrations in water and sediments; special studies of methylmercury production, degradation, and transport; and changes in food web indicators and sentinel species. Adaptive management actions would be triggered when mercury concentrations of sentinel species increase substantially, compared to the reference site, regardless of whether they are over or under desirable levels. If triggers are exceeded, then adaptive management actions would be implemented. Examples of such actions include changing hydraulic residence times or manipulating other factors. Because of the factors described above, impacts would be less than significant.

Alternative A8 A Level of Significance: Less than Significant

Alternative A8 B. Under Alternative A8 B, Phase 2 actions would include import of clean sediment to Pond A8S's southwest and/or southeast corner. This import of sediment would not change water levels in the A8 Ponds or interfere with water circulation. Potential effects from mercury and methylmercury would be similar to those discussed under Alternative A8 A. Adaptive management would be used to monitor effects from tidal marsh restoration. Because adaptive management would be used to minimize adverse effects, impacts would be less than significant.

Alternative A8 B Level of Significance: Less than Significant

Ravenswood Ponds

Alternative Ravenswood A (No Action). Under Alternative Ravenswood A (the No Action Alternative), no new activities would be implemented as part of Phase 2, and Ponds R3, R4 and R5/S5 would continue to function as seasonal ponds. Although the Ravenswood Ponds are known to have—or are expected to have—mercury concentrations below ambient conditions in the Bay, water would not be discharged from the ponds. Therefore, there would be little to no effects to water or sediment quality in adjacent sloughs or the Bay, and impacts would be less than significant.

Alternative Ravenswood A Level of Significance: Less than Significant

Alternative Ravenswood B. Under Alternative Ravenswood B, Pond R4 would be breached to Ravenswood Slough to allow full tidal inundation, and Pond R3 would remain a seasonal pond, but a water control structure would be installed on it to allow inflow from Ravenswood Slough to improve forage habitat for western snowy plover. Ponds R5 and S5 would be converted from seasonal ponds to managed ponds through the construction of water control structures and some earthmoving.

The Ravenswood Ponds are known to have mercury concentrations below ambient conditions in the Bay. Therefore, opening the seasonal ponds to full tidal flows or directional circulation would likely introduce additional mercury-contaminated sediments from the Bay into the ponds. Adaptive management would be used to monitor effects on managed ponds and restored tidal wetlands. Adaptive management actions would be triggered when mercury concentrations of sentinel species increase substantially, regardless of whether they are over or under desirable levels. Because adaptive management would be used to minimize adverse effects, impacts would be less than significant.

Alternative Ravenswood B Level of Significance: Less than Significant

Alternative Ravenswood C. Alternative Ravenswood C would have similar effects to those described for Alternative Ravenswood B, with the following exceptions: Pond R4 would also be breached to the channel between it and Greco Island, Ponds R5 and S5 would be converted to managed mudflats, and water control structures would be installed on Pond R3 to allow inflow to improve forage habitat for western snowy plover. The water control structure connecting Pond R3 to Ravenswood Slough would be opened only during the incoming time to reduce potential discharges.

Potential effects from mercury and methylmercury would be similar to those discussed under Alternative Ravenswood B. Adaptive management would be used to monitor effects to managed ponds and restored tidal wetlands. Because adaptive management would be used to minimize adverse effects, impacts would be less than significant.

Alternative Ravenswood C Level of Significance: Less than Significant

Alternative Ravenswood D. Alternative Ravenswood D would open Pond R4 to tidal flows, remove levees within and between Ponds R5 and S5, convert Ponds R5 and S5 to enhanced managed ponds, allow stormwater outflow from Redwood City to Ponds R5 and S5, and install water control structures on Pond R3. The water control structure connecting Pond R3 to Ravenswood Slough would be opened only during the incoming tide to reduce potential discharges.

Potential effects from mercury and methylmercury would be similar to those discussed under Alternative Ravenswood B. Adaptive management would be used to monitor effects to managed ponds and restored tidal wetlands. Because adaptive management would be used to minimize adverse effects, impacts would be less than significant.

Alternative Ravenswood D Level of Significance: Less than Significant

Phase 2 Impact 3.3-4: Potential impacts to water quality from other contaminants.

The proposed alternatives for Phase 2 of the SBSP Restoration Project have the potential to affect water and sediment quality with various constituents other than mercury, methylmercury, and dissolved oxygen. This section describes the primary mechanisms that could impair water and sediment quality by introduction of these other contaminants. The following program-wide comprehensive design measures are also incorporated into all of the project alternatives.

Actions to Address Increased Mobilization and Transport of Particle-Associated Contaminants. Concentrations of particle-associated "legacy" pollutants, such as PCBs and organochlorine pesticides (e.g., DDT and chlordanes), that were deposited during the times of their historic peak use are often substantially higher in subsurface sediments than surface sediments. It is expected that areas of increased tidal action would result in scour of tidal sloughs and channels. Levee breaching, scour of undersized channels, and increased tidal mixing could lead to temporary increased turbidity and the mobilization and transport of contaminated surface and subsurface sediments. Turbidity increases and contaminant mobility could lead to deposition of such contaminated sediments in restored areas of biological use.

Because of the spatial gradients for mercury and other sediment-associated contaminants (e.g., PCBs, PAHs), it is important to recognize that breaching levees would always have the effect of either releasing contaminant loads from the restored tidal marshes and managed ponds into the Bay or from the Bay into the restored tidal marshes and managed ponds, unless sediment contaminant concentrations are identical in ponds and the Bay. Most of the ponds would be expected to have lower concentrations of urban-associated pollutants such as PCBs and copper in their sediments, because they have been largely cut off from Bay sediments during the past 100 years of industrialization and urbanization. Conversion of ponds to tidal habitat involves accumulation of sediment in the restored ponds, which would cause net losses of particle-associated pollutants from the Bay to the restored ponds.

Sediment monitoring data will be used to determine appropriate disposal or beneficial re-use practices for sediments. If sediment monitoring data indicate that tidal scour outside a levee breach could remobilize sediments that are significantly more contaminated than Bay ambient conditions, the SBSP Restoration Project will consult with the appropriate regulatory agencies regarding other potential required actions.

Actions to Minimize Illegal Discharge and Dumping. State law prohibits littering, and all municipalities in and around the project area have anti-littering ordinances. Implementation of state programs, including stormwater permits, will ensure monitoring for trash and trash abatement measures. Adverse water quality impacts may result from illegal discharges and illicit dumping from the general public as a result of increasing public access to the project area. These discharges or dumping could vary in size and may consist of liquid or solid wastes.

The SBSP Restoration Project will undertake the following activities to ensure that existing programs and practices avoid impacts due to illegal discharge and dumping:

- Gate structures upstream of the SBSP Restoration Project area will include a trash capture device that will prevent fouling of marsh and pond complexes.
- Plans for recreational access in the SBSP Restoration Project area will include appropriate trash collection receptacles and a plan for ensuring regular collection and servicing.
- “No Littering” signs will be posted in public access areas.

Urban Runoff Management. Increased exchange of urban runoff with restored tidal marshes and managed ponds (via tide gates connected to flood control channels or through direct diversion) could transport and/or deposit contaminants, including trash, from urban sources into the restored areas. Urban runoff in the South Bay has been shown to have contaminants such as PAHs, metals (copper and zinc), and urban pesticides (diazinon, pyrethroids) (McKee et al. 2006). Restored tidal marshes and managed ponds could sequester urban pollutants, thereby reducing overall pollutant loads from urban runoff to the Bay. However, the sequestering of urban pollutants in the biologically active restored areas could also render the pollutants more available to biological uptake. The project proponents will notify the appropriate urban runoff program of any physical changes (such as breaches) that will introduce urban discharges into the project area and request that the urban runoff program consider those changes when developing annual monitoring plans.

Alviso-Island Ponds

Alternative Island A (No Action). Under Alternative Island A (the No Action Alternative), existing breaches would continue to allow full tidal inundation at the Island Ponds. Although these breaches would continue to be monitored through special studies, levees and other features at the Island Ponds would not be maintained, with the exception of the Union Pacific Railroad (UPRR) tracks (the maintenance of which is not a component of this project).

Tidal flows could mobilization and transport sediments containing legacy pollutants within the watershed. However, it is unlikely that implementation of Alternative Island A would result in the exceedances of any thresholds discussed above at a frequency greater than under existing conditions. Therefore, impacts would be less than significant.

Alternative Island A Level of Significance: Less than Significant

Alternative Island B. Under Alternative Island B, pond levees would be lowered or removed and Pond A19's northern levee would be breached to Mud Slough. These actions would increase tidal flows in Mud Slough and increase circulation between Ponds A19 and A20. Ongoing operation and maintenance (O&M) activities would not occur at the Island Ponds, with the exception of those discussed under Alternative Island A.

Construction Related Activities. Construction-related activities could lead to transient adverse water quality impacts during or shortly after the period of construction. Breaching or lowering levees could affect water and sediment quality and result in short-term increases in turbidity. Construction activities would also bring equipment and materials not normally present in the project area onto the site. These activities would increase the possibility of exposure to or release of hazardous materials and waste associated with construction, such as fuels or oils, as a result of accidents or equipment malfunction or maintenance. With proper management and oversight, impacts associated with construction activities should not result in exceedances of any thresholds of significant impact. Also, it is unlikely that the impacts associated with mobilization and transport of contaminated sediment would be of a sufficient magnitude or extent as to cause exceedances of the thresholds identified after mitigation. Programmatic Mitigation Measure 3.3-4a applies to Alternative Island B.

Programmatic Mitigation Measure 3.3-4a: Storm Water Pollution Prevention Plan. This measure will mitigate potential impacts due to construction-related activities and maintenance activities. The project sponsors will obtain authorization from the SFRWQCB before beginning construction. As part of this application, the project sponsors will prepare a Storm Water Pollution Prevention Plan (SWPPP) and require all construction contractors to implement the Best Management Practices (BMPs) identified in the SWPPP for controlling soil erosion and discharges of other construction-related contaminants. Routine monitoring and inspection of BMPs will be conducted to ensure that the quality of stormwater discharges is in compliance with the permit. BMPs that will appear in the SWPPP include:

- Soil stabilization measures, such as preservation of existing vegetation to minimize soil disturbance;
- Sediment control measures to prevent disturbed soils from entering waterways;
- Tracking control measures to reduce sediments that leave the construction site on vehicle or equipment tires; and
- Nonstormwater discharge control measures, such as monitoring hazardous material delivery, storage, and emergency spill response requirements, and measures by the project sponsors to ensure that soil-excavation and movement activities are conducted in accordance with standard BMPs regarding excavation and dredging of bay muds, as outlined in the San Francisco Bay Conservation and Development Commission's (BCDC's) bay dredge guidance documents. These BMPs include excavating channels during low tide; using dredge equipment, such as sealing clamshell buckets, designed to minimize escape of the fine-grained materials; and testing dredge materials for contaminants.

The contractor will select specific BMPs from each area, with project sponsor approval, on a site-specific basis. The construction general contractor will ensure that the BMPs are implemented as appropriate throughout the duration of construction and will be responsible for subcontractor compliance with the SWPPP requirements.

Other impacts due to construction-related and maintenance activities can be mitigated by appropriate additions to the SWPPP, including a plan for safe refueling of vehicles and spill containment plans. An appropriate hazardous materials management plan will be developed for any activity that involves handling, transport, or removal of hazardous materials.

Potential effects to water quality from contaminants would be similar to those discussed under Alternative Island A. Implementation of Programmatic Mitigation Measure 3.3-4a would reduce impacts to less-than-significant levels.

Alternative Island B Level of Significance: Less than Significant

Alternative Island C. Under Alternative Island C, levees would be lowered or removed, all three ponds would be breached to Mud Slough, existing levee breaches would be widened, and existing channels inside Pond A19 would be extended to enhance delivery of sediment to the interior of the pond. Potential effects to water quality from contaminants would be similar to those discussed under Alternative Island A. Implementation of Programmatic Mitigation Measure 3.3-4a would reduce impacts to less-than-significant levels.

Alternative Island C Level of Significance: Less than Significant

Alviso-Mountain View Ponds

Alternative Mountain View A (No Action). Under Alternative Mountain View A (the No Action Alternative), Ponds A1 and A2W would continue to be operated with limited directional circulation and the current use of water in Charleston Slough to supply water to Shoreline Park's sailing lake would also continue.

Surface Water Contamination from Groundwater. Because surface water and groundwater are in at least partial hydraulic communication, shallow groundwater could seep into the ponds or restored tidal habitat or the surrounding sloughs and Bay. Although there are numerous fuel and solvent spills affecting the shallow aquifers in industrialized areas of the South Bay, the plumes are generally at least a mile from the salt ponds, with the exception of those at the Moffett Federal Airfield area, which is in the vicinity of the Mountain View Ponds. None of the proposed alternatives for the SBSP Restoration Project are expected to substantially affect either horizontal or vertical groundwater gradients (and resulting groundwater flows) in the area, so the project would not affect the concentrations or the migration rates or directions of plume migration compared to baseline conditions. Also, the water management agencies (primarily SCVWD) and the SFRWQCB (as well as DTSC and the counties) have coordinated programs that together ensure that fuel and solvent spills are identified, contained, and remediated in such a way that neither the ecosystem nor surface water resources are impacted by groundwater contamination.

Maintenance-Related Activities. Although construction activities would not occur under Alternative Mountain View A, hazards could result from the routine maintenance activities required for managed ponds and public access facilities; these activities may include levee repair, dredging, small-scale construction, and general cleaning. Hazardous materials that could lead to water or sediment quality impairments if spilled would primarily include spills and leaks of liquids (fuels and oils) from maintenance vehicles and equipment. The project proponents would implement the control measures specified in the project's waste discharge permit (Water Quality Order No. R2-2008-0078, as revised by R2-2012-0014, or current version). Provisions include specifications for repair, replacement, and servicing of existing facilities, dredging and placement of dredge and/or imported fill material on existing levees, placement of riprap, and general maintenance activities. Implementation of control measures for O&M activities would ensure that impacts would be less than significant.

Alternative Mountain View A Level of Significance: Less than Significant

Alternative Mountain View B. Alternative Mountain View B would increase tidal flows in Ponds A1 and A2W by breaching levees at several locations in Pond A2W and at one location in Pond A1. Levee breaches would allow full tidal inundation to these ponds and increase tidal flows and scour in adjacent sloughs. Alternative Mountain View B would also include raising levees and importing fill material for habitat transition zones.

Construction and Maintenance-Related Activities. Construction-related activities can lead to transient adverse water quality impacts during or shortly after the period of construction. Construction activities that could affect water and sediment quality include placement and grading of levee fill, placement of fill material for habitat transition zones, breaching levees, and construction of hardened crossings; these activities could result in short-term increases in turbidity. Construction activities would increase the possibility of exposure to or release of hazardous materials and waste associated with construction, such as fuels or oils, as a result of accidents, equipment malfunction, or maintenance. Hazards could also result from the routine maintenance activities required for the ponds and public access facilities; these activities may include levee repair, dredging, small-scale construction, and general cleaning. Hazardous materials that could lead to water or sediment quality impairments if spilled would primarily include spills and leaks of liquids (fuels and oils) from maintenance vehicles and equipment. Potential effects to water quality from contaminants other than mercury, methylmercury, and dissolved oxygen would be similar to those discussed under Alternative Island B and Alternative Mountain View A. With proper management and oversight, impacts associated with construction activities should not result in exceedances of any thresholds of significant impact. Also, it is unlikely that the impacts associated with mobilization and transport of contaminated sediment would be of a sufficient magnitude or extent as to cause exceedances of the thresholds identified after mitigation. Programmatic Mitigation Measure 3.3-4a applies to Alternative Mountain View B.

Alternative Mountain View B Level of Significance: Less than Significant

Alternative Mountain View C. Alternative Mountain View C would breach levees and lower levee heights to increase tidal flows in Pond A1, Pond A2W, and Charleston Slough. Pond A1 would be breached at three locations, Pond A2W would be breached at four locations, and the existing levee across Charleston Slough would also be breached or have its tide gates removed. These Phase 2 actions would allow full tidal inundation to Pond A1, Pond A2W, and Charleston Slough, increasing tidal flows and scour in adjacent sloughs. Alternative Mountain View C would also include raising levees and importing fill material for habitat transition zones.

Potential effects to water quality from contaminants other than mercury, methylmercury, and dissolved oxygen would be similar to those discussed under Alternatives Mountain View A and Mountain View B.

Implementation of Programmatic Mitigation Measure 3.3-4a would reduce impacts to less-than-significant levels.

Alternative Mountain View C Level of Significance: Less than Significant

Alviso-A8 Ponds

Alternative A8 A (No Action). Under Alternative A8 A (the No Action Alternative), the A8 Ponds would continue to have muted tidal exchange with Ponds A5 and A7 and with Guadalupe Slough through the Pond A8 notch. Water exchange would be limited and managed, and the tidal range within the ponds would be muted during the dry summer and fall months.

Maintenance-Related Activities. Although construction activities would not occur under Alternative A8 A, hazards could result from the routine maintenance activities required for the managed ponds, which may include levee repair, dredging, small-scale construction, and general cleaning. Hazardous materials that could lead to water or sediment quality impairments if spilled would primarily include spills and leaks of liquids (fuels and oils) from maintenance vehicles and equipment. The project proponents would implement the control measures specified in the project's waste discharge permit (Water Quality Order No. R2-2008-0078, as revised by R2-2012-0014, or current version). Provisions include specifications for repair, replacement, and servicing of existing facilities, dredging and placement of dredge and/or imported fill material on existing levees, placement of riprap, and general maintenance activities. Implementations of control measures for O&M activities would ensure that impacts would be less than significant.

Alternative A8 A Level of Significance: Less than Significant

Alternative A8 B. Under Alternative A8 B, Phase 2 actions would include import of clean sediment to the southwest and/or southeast corner of Pond A8S. This action would not change water levels in the A8 Ponds or interfere with water circulation.

Construction and Maintenance Activities. Construction-related activities could lead to transient adverse water quality impacts during or shortly after the period of construction. Construction of habitat transition zones could result in short-term increases in turbidity. Construction activities would increase the possibility of exposure to or release of hazardous materials and waste associated with construction, such as fuels or oils, as a result of accidents, equipment malfunction, or maintenance. Potential effects to water quality from maintenance-related activities would be similar to those discussed under Alternative A8 A. With proper management and oversight, impacts associated with construction activities should not result in exceedances of any thresholds of significant impact. Implementation of Programmatic Mitigation Measure 3.3-4a would reduce impacts from construction-related activities to less-than-significant levels.

Alternative A8 B Level of Significance: Less than Significant

Ravenswood Ponds

Alternative Ravenswood A (No Action). Under Alternative Ravenswood A (the No Action Alternative), no new activities would be implemented as part of Phase 2 and Ponds R3, R4 and R5/S5 would continue to function as seasonal ponds.

Maintenance-Related Activities. Although construction activities would not occur under Alternative Ravenswood A, hazards could result from the routine maintenance activities, which may include levee repair, dredging, small-scale construction, and general cleaning. Hazardous materials that could lead to water or sediment quality impairments if spilled would primarily include spills and leaks of liquids (fuels and oils) from maintenance vehicles and equipment. The project proponents would implement the control measures specified in the project's waste discharge permit (Water Quality Order No. R2-2008-0078, as revised by R2-2012-0014, or current version). Provisions include specifications for repair, replacement, and servicing of existing facilities, dredging and placement of dredge and/or imported fill material on existing levees, placement of riprap, and general maintenance activities. Implementations of control measures for O&M activities would ensure that impacts would be less than significant.

Alternative Ravenswood A Level of Significance: Less than Significant

Alternative Ravenswood B. Under Alternative Ravenswood B, Pond R4 would be breached to Ravenswood Slough to allow full tidal inundation, and Pond R3 would remain a seasonal pond, but a water control structure would be added to allow inflow to improve forage habitat for western snowy plover. Ponds R5 and S5 would be converted from seasonal ponds to managed ponds through the construction of water control structures and some earthmoving. Levees would be improved, lowered, or removed and a habitat transition zone would be constructed in Pond R4.

Construction and Maintenance-Related Activities. Construction-related activities could lead to transient adverse water quality impacts during or shortly after the period of construction. Levee breaches, modifications to levee heights, and construction of habitat transition zones could result in short-term increases in turbidity. Construction activities would increase the possibility of exposure to or release of hazardous materials and waste associated with construction, such as fuels or oils, as a result of accidents, or equipment malfunction or maintenance. Potential effects to water quality from maintenance-related activities would be similar to those discussed under Alternative Ravenswood A. With proper management and oversight, impacts associated with construction activities would not result in exceedances of any thresholds of significant impact. Also, it is unlikely that the impacts associated with mobilization and transport of contaminated sediment would be of a sufficient magnitude or extent as to cause exceedances of the thresholds identified after mitigation. Implementation of Programmatic Mitigation Measure 3.3-4a would reduce impacts from construction-related activities to less-than-significant levels.

Alternative Ravenswood B Level of Significance: Less than Significant

Alternative Ravenswood C. Alternative Ravenswood C would have similar effects to those described for Alternative Ravenswood B, with the following exceptions: Pond R4 would also be breached to the channel between it and Greco Island, Ponds R5 and S5 would be converted to managed mudflats, and water control structures would be installed on Pond R3 to allow inflow to improve forage habitat for western snowy plover. Levees would be improved, lowered, or removed and a habitat transition zone would be constructed in Pond R4.

Potential effects to water quality from contaminants other than mercury, methylmercury, and dissolved oxygen would be similar to those discussed under Alternative Ravenswood B. Implementation of Programmatic Mitigation Measure 3.3-4a would reduce impacts to less-than-significant levels.

Alternative Ravenswood C Level of Significance: Less than Significant

Alternative Ravenswood D. Alternative Ravenswood D would open Pond R4 to tidal flows, remove levees within and between Ponds R5 and S5, convert Ponds R5 and S5 to enhanced managed ponds, allow stormwater outflow from Redwood City to Ponds R5 and S5, and install water control structures on

Pond R3. Levees would be improved, lowered, or removed and a habitat transition zone would be constructed in Pond R4.

Potential effects to water quality from contaminants other than mercury, methylmercury, and dissolved oxygen would be similar to those discussed under Alternative Ravenswood B, with the exception that stormwater inflow from the Bayfront Canal could be discharged into Ponds R5 and S5. The Bayfront Canal is the stormwater transmission canal for Atherton Channel that discharges through Flood Slough and into the Bay. Peak stormwater flows would be temporarily routed from the Bayfront Canal and Atherton Channel into Ponds R5 and S5.

Increased exchange of urban runoff with restored tidal marshes and managed ponds (via tide gates or other water control structures connected to flood control channels or through direct diversion) could transport and/or deposit sediments and contaminants, including trash, from urban sources into the restored areas. However, the water control structure used to divert stormwater flows into Ponds R5 and S5 would generally allow the first flush of the storm, which often has higher concentrations of urban pollutants, to pass by the ponds. The quality of the stormwater would be managed as part of Redwood City's municipal separate storm sewer system (MS4) permit and in accordance with the Water Quality Monitoring Plan that the City of Redwood City is developing for this project. That plan will include monitoring of stormwater flows in Bayfront Canal prior to diversion into Ponds S5 and R5, installation of trash racks, and an operations plan that would only divert the peak runoff (i.e., after the first flush of the storm) into the restoration area. Therefore, adverse impacts to the ponds would be minimized. Implementation of Programmatic Mitigation Measure 3.3-4a would reduce construction impacts to less-than-significant levels.

Alternative Ravenswood D Level of Significance: Less than Significant

Phase 2 Impact 3.3-5: Potential to cause seawater intrusion of regional groundwater sources.

Factors associated with the risk of future salinity intrusion include improperly abandoned wells and salinity migration into areas with poorly confined aquifers. Migration of Bay waters up creeks and sloughs was documented as a historical cause of salinity intrusion, and artificial pathways increase the risk of seawater intrusion into regional groundwater supplies. As described in Section 3.3.1, Physical Setting, historic overdraft conditions during the early- to mid-1900s that lowered groundwater levels have been reversed over the past 40 years. Today, water flows from groundwater basins into the Bay. As long as that condition persists, there is no significant risk of salinity intrusion into drinking water aquifers.

Management of Abandoned Wells. The management of abandoned wells is a program-wide comprehensive design measure incorporated into all Action Alternatives. If any abandoned wells are found before or during construction, they will be properly destroyed by the project as per local and state regulations by coordinating such activities with the local water district. If abandoned wells are located during restoration or other future activities within SCVWD boundaries, a well destruction work plan will be prepared in consultation with SCVWD (as appropriate) to ensure conformance to SCVWD specifications. The work plan will include consulting the databases of well locations already provided by SCVWD. The project will properly destroy both improperly abandoned wells and existing wells within the project area that are subject to inundation by breaching levees. Well destruction methods will meet local, county, and state regulations. The project proponents will also lend support and cooperation with any well identification and destruction program that may be undertaken as part of the U.S. Army Corps of Engineers' Shoreline Study or other projects

Alviso-Island Ponds

Alternative Island A (No Action). Under Alternative Island A (the No Action Alternative), the Island Ponds would continue to have tidal inundation. Tidal inundation of ponds with water levels that are currently at or near mean sea level would not result in significant changes in groundwater hydrology. Continued tidal inundation would not cause a salinity gradient to migrate landward, as compared to existing conditions. Impacts would be less than significant.

Alternative Island A Level of Significance: Less than Significant

Alternative Island B. Potential effects of Alternative Island B would be similar to those discussed under Alternative Island A. Impacts would be less than significant.

Alternative Island B Level of Significance: Less than Significant

Alternative Island C. Potential effects of Alternative Island C would be similar to those discussed under Alternative Island A. Impacts would be less than significant.

Alternative Island C Level of Significance: Less than Significant

Alviso-Mountain View Ponds

Alternative Mountain View A (No Action). Under Alternative Mountain View A (the No Action Alternative), the Mountain View Ponds would continue to be operated for directional circulation. Managed ponds with water levels that are somewhat below mean sea level would not result in significant changes in groundwater hydrology. Impacts would be less than significant.

Alternative Mountain View A Level of Significance: Less than Significant

Alternative Mountain View B. Ponds A1 and A2W would be opened to full tidal flows. Tidal inundation of managed ponds with water levels that are currently somewhat below mean sea level would not result in a significant change in groundwater hydrology. Although the increased tidal prism would draw Bay waters through the sloughs to the breach locations, Mountain View Slough and Whisman Slough are likely to already have similar salinities as the open waters at these locations because of close proximity to the Bay, except during storm events. The salinity in upstream creeks is not expected to change substantially, and groundwater currently has positive flow into the Bay. Impacts would be less than significant.

Alternative Mountain View B Level of Significance: Less than Significant

Alternative Mountain View C. The potential effects of seawater intrusion to regional groundwater sources under Alternative Mountain View C would be similar to those discussed under Alternative Mountain View B. Impacts would be less than significant.

Alternative Mountain View C Level of Significance: Less than Significant

Alviso-A8 Ponds

Alternative A8 A (No Action). Under Alternative A8 A (the No Action Alternative), the A8 Ponds would continue to be operated for muted tidal circulation. Managed ponds with water levels that are currently at or near sea level would not result in substantial changes in groundwater hydrology. Impacts would be less than significant.

Alternative A8 A Level of Significance: Less than Significant

Alternative A8 B. The potential effects of Alternative A8 B would be similar to those discussed under Alternative A8 A. Impacts would be less than significant.

Alternative A8 B Level of Significance: Less than Significant

Ravenswood Ponds

Alternative Ravenswood A (No Action). Under Alternative Ravenswood A (the No Action Alternative), the Phase 2 Ravenswood Ponds would continue to be operated as seasonal ponds, with little to no exchange with adjacent sloughs or the Bay. Impacts would be less than significant.

Alternative Ravenswood A Level of Significance: Less than Significant

Alternative Ravenswood B. The flooding of seasonal ponds would provide beneficial changes in pond salinity. Salinity in tidally inundated ponds would continue to decline to concentrations comparable to the Bay. The flooding of seasonal ponds would not cause any significant change in the horizontal or vertical hydraulic gradients. A change of a 5 feet or less is not likely to be enough to change the direction of either horizontal flow or vertical flow, since groundwater levels generally fluctuate several feet in a normal year.

Prior hydrodynamic modeling results for salinity indicate that salinity would not increase substantially in the Ravenswood pond complex (2007 EIS/R, Appendix J). Therefore, the risk of salinity intrusion from stream channel modifications or operational changes would be minimal. Breaching of levees and tidal inundation of low-lying ponds could pose a risk of seawater intrusion if such actions were to inundate improperly abandoned wells and groundwater overdraft occurs in the future. However, program-wide design measures include management of abandoned wells (described above). Therefore, impacts would be less than significant.

Alternative Ravenswood B Level of Significance: Less than Significant

Alternative: Ravenswood C. The potential effects of Alternative Ravenswood C would be similar to those discussed under Alternative Ravenswood B. Impacts would be less than significant.

Alternative Ravenswood C Level of Significance: Less than Significant

Alternative Ravenswood D. The potential effects of Alternative Ravenswood D would be similar to those discussed under Alternative Ravenswood B. Impacts would be less than significant.

Alternative Ravenswood D Level of Significance: Less than Significant

Impact Summary

Impacts, mitigation measures, and the level of significance after mitigation are summarized in Table 3.3-6. With the incorporation of mitigation, all impacts would be less than significant.

Table 3.3-6. Phase 2 Summary of Impacts – Water Quality

IMPACT	ALTERNATIVE											
	ISLAND			MOUNTAIN VIEW			A8		RAVENSWOOD			
	A	B	C	A	B	C	A	B	A	B	C	D
Phase 2 Impact 3.3-1: Degradation of water quality due to changes in algal abundance or composition.	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS
Phase 2 Impact 3.3-2: Degradation of water quality due to low dissolved oxygen levels.	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS
Phase 2 Impact 3.3-3: Degradation of water quality due to increased methylmercury production or mobilization of mercury-contaminated sediments.	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS
Phase 2 Impact 3.3-4: Potential impacts to water quality from other contaminants.	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS
Phase 2 Impact 3.3-5: Potential to cause seawater intrusion of regional groundwater sources.	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS

Notes:
Alternative A at each pond cluster is the No Action Alternative (No Project Alternative under CEQA).
LTS = Less than Significant

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