Chapter 4
Water Quality

4.1 Environmental Setting

4.1.1 Introduction and Sources of Information

This chapter describes the physical and chemical environment of the Napa River Unit with respect to marsh sediments and water quality in the salt ponds and surrounding surface water bodies (Napa River and San Pablo Bay). Information on the existing conditions is derived from extensive water quality monitoring conducted by the USGS; UCD historical data records for the Napa River and San Pablo Bay; and recent sediment and water quality sampling conducted specifically for the project by Hydroscience Engineers. This chapter also describes the results of a hydrodynamic and water quality model developed for the restoration project by PWA.

Data regarding the quality of water currently discharged from the SVCSD, NSD, and CAC WWTPs (i.e., the Project Component of the Water Delivery Option discussed in Section 4.2.7) were provided by WWTP staff.

4.1.2 Regulatory Setting

Several state and federal agencies have regulatory authority or responsibility over project-related activities that affect water quality. Table 4-1 below summarizes project-related activities, the environmental resources potentially affected by each activity, and the government agency with regulatory authority over the activity.

Table 4-1. Summary of Regulatory Setting for Water Quality

Project-Related Activity	Regulatory Authority
Construction activities that could adversely affect water quality	RWQCB–NPDES stormwater permit (CWA Section 402); CWA Section 401 water quality certification
Operations of controlled levee breaches and/or physical structures (e.g., pumps, weirs, siphons) to facilitate flushing and dilution of salt ponds	RWQCB–NPDES individual permit and/or WDRs (Porter-Cologne Act and Basin Plan) for waste discharge to waters of the state; CWA Section 401 water quality certification

RWQCB = Regional Water Quality Control Board
NPDES = National Pollutant Discharge Elimination System
WDRs = waste discharge requirements
CWA = Clean Water Act
Basin Plan = *Water Quality Control Plan, San Francisco Bay Region*

4.1.2.1 Regional Water Quality Control Board Authority

The RWQCBs have primary authority for implementing provisions of the federal CWA and California's Porter-Cologne Water Quality Control Act. These statutes establish the process for developing and implementing planning, permitting, and enforcement authority for waste discharges to land and water. The *Water Quality Control Plan, San Francisco Bay Region* (Basin Plan) establishes beneficial uses for surface and groundwater resources and sets regulatory water quality objectives that are designed to protect those beneficial uses (San Francisco Bay RWQCB 1995). Under the current Basin Plan, designated beneficial uses of the San Francisco Bay area's surface waters include municipal and domestic supply; agricultural supply; industrial service supply; groundwater recharge; contact and noncontact recreation; warm freshwater fish habitat; cold freshwater fish habitat; wildlife habitat; migration of aquatic organisms; and spawning, reproduction, and/or early development of fish. Beneficial uses of San Francisco Bay area groundwater include municipal and domestic supply, agricultural supply, and industrial service supply.

The Basin Plan establishes numeric and narrative surface and groundwater water quality objectives designed to protect designated beneficial uses of surface water and groundwater resources. Other applicable water quality criteria include the California Toxics Rule (CTR), which establishes numeric criteria for aquatic life and human health protection for approximately 130 priority trace metal and organic constituents. Numeric water quality objectives include specific concentration-based values that may be imposed on the effluent or at the edge of an allowable mixing zone within the receiving water. Numeric Basin Plan and CTR criteria differ depending on the salinity content.

The Basin Plan defines fresh water, saltwater, and estuarine waters as follows: Fresh water has a salinity of less than 5 ppt more than 75% of the time; saltwater has a salinity of more than 5 ppt more than 75% of the time; and estuarine water has a salinity that is between that of fresh water and saltwater. In general, the lower of the saltwater or fresh water quality criteria apply to estuarine conditions.

The San Francisco Bay RWQCB applies estuarine water quality criteria to San Pablo Bay and the Napa River. Narrative criteria provide general guidance to avoid adverse water quality impacts for constituents including salinity, sediment (i.e., total suspended solids [TSS]), tastes and odors, sulfides, toxicity, and bioaccumulation. Numeric criteria included in the Basin Plan include such parameters as trace metals, dissolved oxygen, turbidity, temperature, pH, bacteriological pathogens, and un-ionized ammonia. Table 4-2 shows selected surface water quality objectives of potential concern for tidal wetland restoration projects and applicable numeric and narrative criteria.

Table 4-2. Surface Water Quality Objectives for Potential Constituents of Concern

Constituent	Units	Water Quality Objective *
Temperature	°F	Controllable water quality factors shall not increase temperature by more than 5°F.
Dissolved oxygen	mg/l	5.0 mg/l. Minimum dissolved oxygen is applicable to tidal waters downstream of Carquinez Bridge. The median dissolved oxygen concentration for any 3 consecutive months shall not be less than 80% of the dissolved oxygen content at saturation.
Salinity	ppt	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.
pH	standard units	6.5 to 8.5. The pH shall not be depressed below 6.5 or raised above 8.5. This range encompasses the pH range usually found in waters within the basin. Controllable water quality factors shall not cause changes of greater than 0.5 unit in normal ambient pH levels.
Turbidity	NTU	Waters shall be free of changes in turbidity that could cause nuisance or adversely affect beneficial uses. Increases of turbidity as a result of waste discharge shall not be greater than 10% in areas where natural turbidity is greater than 50 NTU.
Sediment	mg/l	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.
Sulfide	mg/l	All water shall be free of 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.
Toxicity	NA	All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms. There shall be no acute toxicity in ambient waters. Acute toxicity is defined as a median of less than 90% survival, or less than 70% survival more than 10% 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.

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Table 4-2. Continued

Constituent	Units	Water Quality Objective [1]
Bioaccumulation	NA	Many pollutants can accumulate on particles or 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.
Arsenic	μg/l	36 [S], 150 [F]
Cadmium	μg/l	9.3 [S], 1.1 [F]
Chromium, total	μg/l	180 [F]
Chromium, hexavalent	μg/l	50 [S], 11 [F]
Copper	μg/l	3.1 [S], 9.0 [F]
Lead	μg/l	5.6 [S], 2.5 [F]
Nickel	μg/l	8.2 [S], 5.2 [F]
Silver [2]	μg/l	1.9 [S], 3.4 [F]
Selenium	μg/l	7.1 [S], 5.0 [F]
Mercury	μg/l	0.025 [S], 0.025 [F]
Zinc	μg/l	81 [S], 23 [F]
PCBs, total [3]	μg/l	0.000170 [S], 0.000170 [F]

[1] Narrative objectives are used where numeric objectives have not been established. Unless noted otherwise, single numeric values represent the chronic exposure (4-day average) concentration not to be exceeded at a frequency exceeding once every 3 years. Trace metal criteria represent the lower of the Basin Plan objectives or California Toxics Rule (CTR) for saltwater (S) or freshwater (F) conditions.

[2] Criteria applicable to acute exposure concentration only (instantaneous maximum).

[3] CTR human health criteria for consumption of organisms.

Notes:

mg/l = milligrams per liter
μg/l = micrograms per liter
ppt = parts per thousand
NTU = nephelometric turbidity units
NA = not applicable
PCBs = polychlorinated biphenyl compounds

Disposal Option Sediment Screening Criteria

The San Francisco Bay RWQCB also established sediment screening criteria and testing requirements for the beneficial reuse of dredged material (e.g., wetlands creation and upland disposal). The criteria are intended to facilitate the creation, enhancement, and restoration of wetlands in marine and estuarine environments. The criteria were developed in part based on Effects Range–Low (ER-L) and Effects Range–Median (ER-M) criteria originally developed by NOAA (California Department of Water Resources 1995). The ER-L criteria reflect the concentration below which adverse biological effects may be expected to occur less than 10% of the time. ER-M criteria reflect the concentration below which adverse biological effects may be expected to occur less than 50% of the time.

The RWQCB criteria specify the allowable use based on two categories: use for wetland noncover where exposure to the aquatic environment would be limited and wetland cover or levee construction where sediments would be exposed to the water. Table 4-3 shows the applicable criteria for trace metals and organic compounds.

Table 4-3. RWQCB Disposal Option Sediment Screening Criteria

	Criteria	
Constituent	Wetlands Creation Noncover (mg/kg, dry weight)	Wetlands Creation Cover and Levee Restoration (mg/kg, dry weight)
Arsenic	33–85	<33
Cadmium	5–9	<5
Chromium, total	220–300	<220
Copper	90–390	<90
Lead	50–110	<50
Nickel	140–200	<140
Mercury	0.35–1.3	<0.35
Selenium	0.7–1.4	<0.7
Silver	1.0–2.2	<1.0
Zinc	160–270	<160
PAHs, total	4–35	<4
DDT	0.003–0.1	<0.003
PCBs, total	0.05-–0.4	<0.05

Notes: mg/kg = milligrams per kilogram; PAH = polycyclic aromatic hydrocarbon

4.1.2.2 CWA Section 402 and RWQCB Permitting Procedures

Section 402 of the CWA prohibits the discharge of all pollution into surface waters unless permitted under the National Pollutant Discharge Elimination System (NPDES), which is administered by the U.S. Environmental Protection Agency (EPA), or by a state agency with a federally approved control program. In California, Section 402 authority has been delegated to the SWRCB and is administered by RWQCBs.

To ensure conformance with the Basin Plan and the federal CWA, the RWQCB issues WDR and/or NPDES permits to projects that may discharge wastes to land or water. The federal NPDES permit system includes procedures for point-source waste discharges and stormwater discharges. It is anticipated that the San Francisco Bay RWQCB would not impose an NPDES point-source discharge permit on the proposed project because the project is considered a long-term beneficial water reclamation and wetland restoration project. However, the RWQCB administers the statewide general NPDES stormwater permit for general construction activity that applies to projects that disturb more than 5 acres of land; this permit will most likely be required. The NPDES permit requires filing with the San Francisco Bay RWQCB a public notice of intent (NOI) to discharge stormwater and preparation and implementation of a stormwater pollution prevention plan (SWPPP). The SWPPP must include a site map and description of construction activities and identify BMPs that would be employed to prevent soil erosion and discharge of other construction-related pollutants (e.g., petroleum products, solvents, paints, cement) that could contaminate receiving waters. Monitoring may be required to ensure that BMPs are implemented according to the SWPPP and are effective at controlling discharges of stormwater-related pollutants.

Erosion and sediment delivery to the Napa River would be minimized during project construction. Related efforts would include measures to minimize the potential for sediment to enter the river as well as interim measures to stabilize soil pending establishment of vegetative cover. As part of the SWPPP required for project construction, an erosion and sediment control plan would be prepared and incorporated into project construction plans and specifications. More specifically, for stormwater discharges from construction sites, SWRCB Order 99-08-DWQ authorizes NPDES general permit No. CAS000002, Waste Discharge Requirements for Discharge of Storm Water Runoff Associated with Construction Activity. The San Francisco Bay RWQCB implements the provisions of general permit CAS000002 and may issue an individual NPDES permit and waste discharge requirements for construction activities or projects found ineligible for coverage under the general permit. The selected contractor(s) would be responsible for implementing the erosion and sediment control plan under Corps supervision, as required by the permitting process of the NPDES.

If a general permit application for either stormwater or groundwater extraction is found ineligible for permitting under the limitations and requirements of a general permit, the San Francisco Bay RWQCB may consider authorizing a single individual permit incorporating provisions applicable to both stormwater and groundwater extraction activities.

4.1.2.3 CWA Section 401—Water Quality Certification

Under CWA Section 401, applicants for a federal license or permit to conduct activities that may result in the discharge of a pollutant into waters of the United States must obtain certification from the state in which the discharge would originate or, if appropriate, from the interstate water pollution control agency with jurisdiction over affected waters at the point where the discharge would originate. Therefore, all projects that have a federal component and may affect state water quality (including projects that require federal agency approval [such as issuance of a Section 404 permit]) must also comply with CWA Section 401. In California, the authority to grant water quality certification has been delegated to the State Water Resources Control Board (SWRCB) and applications for water quality certification under CWA Section 401 are typically processed by the RWQCB with local jurisdiction. Water quality certification requires evaluation of potential impacts in light of water quality standards and CWA Section 404 criteria governing discharge of dredged and fill materials into waters of the United States.

For purposes of this project, the Corps will obtain certification from the San Francisco Bay RWQCB under Section 401.

4.1.2.4 CWA Section 303(d)—Water Quality Limited Water Bodies

Under CWA Section 303(d), the RWQCB and SWRCB list water bodies as impaired when not in compliance with designated water quality objectives and standards. A total maximum daily load (TMDL) program must be prepared for waters identified by the state as impaired. A TMDL is a quantitative assessment of a problem that affects water quality. The problem can include the presence of a pollutant, such as a heavy metal or a pesticide, or a change in the physical property of the water, such as DO or temperature. A TMDL specifies the allowable load of pollutants from individual sources to ensure compliance with water quality standards. Once the allowable load and existing source loads have been determined, reductions in allowable loads are allocated to individual pollutant sources.

The Napa River is currently identified on the EPA Section 303(d) list for the state as being impaired by nutrients, pathogens, and sedimentation. TMDL programs are planned for these constituents with projected completion by 2005. The identified sources of the contaminants include a full range of agriculture, urban runoff, resource extraction, atmospheric deposition, and natural sources.

Sonoma and Petaluma Creeks are included on the 303(d) list because of high levels of nutrients, pathogens, and sedimentation from agriculture, development, and urban runoff. Both TMDL processes are scheduled for completion in 2005. Novato Creek is on the 303(d) list for diazinon contamination (as are all San Francisco Bay urban creeks) because of urban runoff; the TMDL process is scheduled for completion by 2004.

San Pablo Bay is listed as impaired for several organochlorine pesticides, the organophosphorus pesticide diazinon, dioxin and furan compounds, polychlorinated biphenyl (PCB) compounds, copper, mercury, nickel, and selenium. Development of the TMDL for mercury in the greater San Francisco Bay is currently underway. North San Francisco Bay, including San Pablo Bay, is being evaluated to determine whether impairment by copper is actually a problem. As a result of this effort, San Pablo Bay may eventually be delisted for copper. The TMDLs that will be required for San Pablo Bay are in various states of development and are projected for completion in 2010. A mercury TMDL report has been completed that describes the problem conditions and assessment of sources (San Francisco Bay RWQCB 2000).

4.1.2.5 Section 313

Section 313 of the CWA (33 USC 1323) states:

> …each department, agency, or instrumentality of the executive, legislative, and judicial branches of the federal government having jurisdiction over any property or facility, or engaged in any activity resulting, or which may result, in the discharge or runoff of pollutants…shall be subject to, and comply with, all federal, state, interstate and local requirements, administrative authority, and process and sanctions respecting the control and abatement of water pollution in the same manner, and to the same extent as any nongovernmental entity.

The Corps would comply with Section 313 of the CWA by complying with Sections 404, 401, and 402 of the CWA, California Fish and Game Code Section 1600, and regional and local requirements of the San Francisco Bay RWQCB and SWRCB through the Basin Plan and NPDES permitting. A Corps project does not need a Section 404 permit; instead, the Corps conducts an equivalent evaluation in-house. This Section 404(b)(1) evaluation is described in Appendix B. The Corps would consider and mitigate changes in habitat, salinity, and other water quality parameters through project modification and, if necessary, mitigation.

4.1.2.6 Water Recycling Law

Chapter 7 of the California Water Code, also known as the Water Recycling Law, establishes the intent of the legislature to encourage water recycling as a method to increase the ability to meet the growing water needs within California. The law authorized the SWRCB to loan money to local agencies to develop water reclamation facilities and directed the state Department of Health Services (DHS) to create water recycling criteria. In addition, it developed reporting requirements and established permitting procedures for the regional boards in conjunction with DHS.

4.1.2.7 Title 22, California Code of Regulations Criteria for Recycled Water Quality

DHS holds the authority to set criteria for recycled water production and use. Title 22, Division 4 of the California Code of Regulations (CCR) defines these criteria, which pertain to treatment processes, water quality, and reliability. Title 22 establishes minimum water quality criteria requirements for various use categories, including irrigation, wetlands, and industrial uses. Table 4-4 lists the treatment levels required for different uses of reclaimed water that are possible within the north bay region.

Table 4-4. Water Treatment Requirements for Recycled Water Use

Treatment Level	User Categories
Disinfected tertiary treatment	Food crops where recycled water comes into direct contact with edible portions; parks and playgrounds; school yards; and unrestricted access golf courses
Disinfected secondary treatment with coliform not exceeding a most probable number of 23 per 100 milliliters	Restricted access golf courses; pasture for animals producing milk for human consumption; and nonedible vegetation where access is controlled
Undisinfected secondary treatment	Orchards or vineyards where the recycled water does not come into contact with edible portion; and fodder or pasture for animals not producing milk for human consumption

Title 22 also sets forth requirements for separation between areas irrigated with reclaimed water and domestic groundwater wells, with separation distances as follows:

- 50 feet for disinfected tertiary treated water (unless several additional criteria are met),
- 100 feet for disinfected secondary water, and
- 150 feet for undisinfected secondary water.

4.1.2.8 RWQCB Policy on Use of Wastewater to Create, Restore, or Enhance Wetlands

In the north bay, the RWQCB prohibits discharges of municipal wastewater effluent discharges that exceed the applicable water quality standards if the quantity of receiving water does not provide an initial dilution capacity for the effluent of at least 10:1. Resolution 94-086 established objectives and guidance for an exception to this shallow-water-discharge restriction that allows effluent discharges in such situations if the effluent is used to create, restore, and/or enhance wetlands. The policy requires that the wetland restoration project must provide a net environmental benefit and the beneficial uses that are established in the wetland must be fully protected. A management plan must be prepared that describes project objectives, design and engineering considerations, operations and maintenance procedures, and monitoring programs.

4.1.3 Regional Setting

The hydrologic processes and fate and transport factors for chemical constituents in San Francisco Bay, its tributary rivers, and adjacent estuaries are complex and result in dynamic water quality conditions. Water quality in the Bay-Delta estuary is largely a function of the mixing of ocean water and freshwater inflows from precipitation, the Delta, and other tributary streams. The physical mixing of sediment, nutrients, and salts combine with natural processes of light and heat input and associated primary and secondary production in higher trophic levels in the aquatic ecosystem of the bay. These ecosystem functions have secondary effects on dissolved oxygen, pH, and organic matter production and decay. In addition, the discharge of anthropogenic sources of conventional inorganic contaminants and trace metal and synthetic organic compounds also play a major role in the quality of bay water and sediments. Examples include municipal and industrial wastewater treatment discharges and urban stormwater runoff.

4.1.3.1 Salinity

Salinity in the Bay-Delta estuary reflects a balance between the saline marine influence, freshwater dilution, and the effects of evaporation. Undiluted seawater has an average salinity of about 35 ppt and distilled fresh water is defined as having 0 ppt salinity. Estuarine or brackish water represents salinity that lies between pure freshwater and pure saltwater conditions. Saltwater is considerably more dense than fresh water; therefore, fresh water will float on top of saline water. The density difference between saline and fresh water conditions also influences physical mixing between water layers of varying density. In general, salinity is lower in the northern portion of San Francisco Bay and higher in the southern portion, because San Pablo Bay receives substantially greater freshwater influx from the Delta. Freshwater inflow from the Delta also contributes to a much greater seasonal variation in salinity conditions in the north bay than in the south bay. The salinity in the sloughs of San Pablo Bay varies seasonally. During periods of high flow (particularly the winter rainy season), increased freshwater influx via San Pablo Bay’s creeks decreases the salinity in the sloughs. Slough salinities increase during the summer low-flow period when freshwater influx is reduced.

The USGS and San Francisco Estuary Institute Regional Monitoring Program (RMP) conduct extensive water quality monitoring activities in San Francisco Bay and its freshwater tributaries (San Francisco Estuary Institute 1999, 2000a). The USGS operates a continuous salinity meter at Point San Pablo and has operated several continuous TSS recorders (e.g., Benicia Bridge, Carquinez Bridge, Point San Pablo) in recent years. Figure 4-1 shows a time series of continuous salinity measurements collected at Point San Pablo and the San Mateo Bridge during the 1998 water year in relation to Delta outflow (U.S. Geological Survey 2000c). (Note that this figure shows data from an extremely wet year that is not at all typical.) Analyses indicate that salinity in San Pablo Bay varies over a wide range during the year from nearly fresh water to nearly pure sea water. Salinity also exhibits a distinct variation that correlates with the spring-neap tidal cycle with spring tides having greater energy to force seawater further into the estuary. The spring-neap tidal cycle is generally more pronounced in the north bay.

4.1.3.2 Suspended Sediment

Like salinity, suspended sediment concentration is controlled by a balance of factors. Key influences on suspended sediment are loading from inland streams, tidal influences on dilution and mass loading of biotic suspended matter (algae, zooplankton), and resuspension of previously deposited sediments within the bay. Resuspension of sediments within the bay is a function of tidal currents, wind strength and direction (i.e., the strength of wind-driven wave currents), and freshwater inputs. Freshwater influx shows a strong seasonal variation, with a peak during the winter (November–April) rainy season; land-derived sediment loading shows a corresponding peak in the winter. Tidal currents vary on a semimonthly basis from neap tides to spring tides, with the greatest sediment mobility at spring tides.

In general, TSS concentrations are highest in the San Pablo Bay region and at the southern end of San Francisco Bay. TSS concentrations are typically lower in central San Francisco Bay. USGS data show average concentrations of ~80–150 milligrams per liter (mg/l) in San Pablo Bay (Northwest Hydraulic Consultants 2001). High TSS levels in San Pablo Bay are generally associated with sediment input associated with Delta inflows.

Figure 4-2 shows continuous TSS concentration monitoring data at Point San Pablo for the 1998 water year that indicates seasonal conditions are influenced by a combination of Delta inflow and tidal action in San Francisco Bay (U.S. Geological Survey 2001). Figures 4-3 and 4-4 show seasonal variation of TSS data for the 1999 water year at Point San Pablo and within the Mare Island Strait for both mid-depth and near-bottom locations in the water column (U.S. Geological Survey 2001). These plots reflect the wide range of TSS concentrations that can be present as influenced by Delta outflow discharge patterns and tidal action. Measured TSS concentrations range from relatively low values less than 50 mg/l TSS to very turbid conditions exceeding 1,000 mg/l TSS. Seasonal RMP grab samples also indicate that TSS concentrations are generally elevated in the Napa and Petaluma Rivers compared to San Pablo Bay (San Francisco Estuary Institute 2000a). However, the total sediment transport from the upper watersheds is minimal compared to the quantities of sediment derived from Delta outflow and wind- and wave-driven resuspension of bay sediments. In addition, Warner (2000) identified a complex tidally and salinity driven mechanism that acts to increase TSS transport into Mare Island Strait and the lower Napa River from the Carquinez Strait. Essentially, the earlier timing of flood tides with high TSS levels into Mare Island Strait compared to the Carquinez Strait provides high TSS conditions, and the convergence with lower salinity Napa River outflow creates a standing wave that allows elevated deposition rates.

4.1.3.3 Priority Trace Metal and Organic Compounds in Water and Sediment

Water

Water and sediment contamination from priority trace metal and synthetic organic compounds in the San Francisco Bay area largely reflects the influence of past and present agricultural and mining activities, industrial uses, and urban development (San Francisco Estuary Institute 1999). Contaminants known to be present in waters and sediments of the Bay-Delta estuary include heavy metals (lead, copper, aluminum, mercury, nickel, vanadium, chromium, silver, zinc), polycyclic aromatic hydrocarbons (PAHs), PCBs, chlorinated hydrocarbon pesticides, and tributyltin (San Francisco Estuary Institute 1999, 2000a, San Francisco Bay RWQCB 1998).

Within the north bay region, constituents of concern that routinely exceed numeric guidance levels, human health guidelines, and/or regulatory concentration criteria in water samples collected for the RMP monitoring program include copper, mercury, and PCBs (San Francisco Estuary Institute 2000a). Table 4-5 shows RMP average concentration values for selected constituents measured during the 1993–1999 period in the Napa River and San Pablo Bay. For the Napa River and San Pablo Bay samples, only copper exceeded applicable criteria on an average basis; however, individual measurements of mercury, copper, nickel, chromium, lead, and zinc exceeded criteria on one or more occasions (San Francisco Estuary Institute 1999). Organic compound concentrations of PCBs and dichlorodiphenyldichloroethelene (DDE) were also measured above water quality guidelines at least once in the Napa River and San Pablo Bay. The sum of 40 PCB congeners was well above the congener-based total-PCB criterion of 170 picograms per liter (pg/l) in all but eight of the RMP sampling locations. While the concentrations of PCBs have dropped since the 1970s, the RMP monitoring data have shown no clear trends in recent years. Measured exceedances of metals and organic compounds occurred less frequently in other north bay sampling locations (i.e., Davis Point, Pinole Point).

The sources and magnitude of contaminant loading to San Francisco Bay have been recently characterized as consisting primarily of the following categories: Central Valley via Delta inflows, local runoff of rivers and stormwater runoff, point-source discharges to the bay from municipal and industrial facilities, atmospheric deposition, and dredged material disposal (San Francisco Estuary Institute 2000b). Overall, the report indicated that TSS and contaminant influxes from the Delta comprise a large majority of the total loading in San Francisco Bay. Atmospheric deposition and dredged material disposal represent relatively small contributions.

The relative magnitude of contaminant loading from local watershed sources and point-source discharges depends on the particular chemical constituent in question. For example, point-source discharges comprise the majority of inorganic nutrient (nitrogen [N] and phosphorus [P]) loading to San Francisco

Bay, whereas trace metals inputs are primarily associated with local watershed sources. Relative source contributions of organic compounds have not been determined. Within the category of local watershed runoff, the Napa River, Petaluma River, and Sonoma Creek watersheds were found to contribute a relatively high percentage of the total San Francisco Bay area load of selected trace metals (cadmium, chromium, copper, lead, nickel, and zinc) compared to other watersheds.

Table 4-5. Water Contaminant Levels of the Napa River, San Pablo Bay and the Salt Ponds Project Area[1]

Location[2]	Salinity (tds)	As (µg/l)	Cr (µg/l)	Cu (µg/l)	Pb (µg/l)	Hg (µg/l)	Ni (µg/l)	Zn (µg/l)	Total PCBs (µg/l)[3]
Napa River	—	2.8	12.0	5.9	2.0	0.021	10.2	13.0	0.000558
San Pablo Bay	—	2.6	11.5	5.5	2.0	0.024	9.3	8.6	0.000758
Pond 1	40,050	19.5	<10	31	10	<0.1	<10	13	<MRL
Pond 1A	163,950	12.0	<10	53	<2	<0.1	<10	47	<MRL
Pond 2	38,425	10.5	<10	34	<2	<0.1	11	26	<MRL
Pond 2A	21,850	<6	<10	20	<2	<0.1	<10	<20	<MRL
Pond 3	66,475	ND	ND	53	ND	ND	ND	59	<MRL
Pond 4	323,000	<30	<500	287	<100	<0.5	<500	725	<MRL
Pond 5	323,667	87.0	<100	253	<20	<0.1	<100	1027	<MRL
Pond 6	92,100	<24	28.7	<40	<8	<0.1	<40	75	<MRL
Pond 6A	57,533	<24	<40	<40	<8	<0.1	<40	<80	<MRL
Pond 7	353,500	125	<100	1519	<20	<1.0	90	3380	<MRL
Pond 7A	96,400	<60	<100	65	<20	<0.5	<100	<200	<MRL
Pond 8	293,667	<300	<500	373	<100	<0.5	<500	1840	<MRL

- No Data

1 Average of measurements at each salt pond in total dissolved solids (tds); measurements can vary substantially during the year depending on the pond depth and amount of rainwater present in a pond.

2 Sources: Napa River and San Pablo Bay values calculated from San Francisco Estuary Institute data (URL:/ www.sfei.org/rmp/data.htm); salt pond data from Hydroscience 2002.

3 Total PCBs concentration data from salt ponds were all below method reporting limit (MRL), which varied from 0.5 to 2.5 µg/l.

Table 4-6. Sediment Contaminant Levels of the Napa River, San Pablo Bay, and the Salt Ponds Project Area[1]

Location[2]	As (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	Ni (mg/kg)	Se (mg/kg)	Zn (mg/kg)	Total PCBs (µg/kg)[3]	Total PAHs (µg/kg)[4]	Total DDTs (µg/kg)[5]
Napa River	12.9	109	61.3	25.9	0.330	104	0.55	144	5.92	1279	5.46
San Pablo Bay	14.1	92.4	49.3	21.3	0.330	84.6	0.43	118	4.02	4274	4.07
Pond 1	12.6	109	60.2	31.7	0.335	107	1.4	126	<MRL	- -	1.88
Pond 1A	14.0	87	45.0	29.6	0.180	77.6	1.4	82	<MRL	<MRL	<MRL
Pond 2	15.3	95	37.7	19.8	0.115	84.6	0.98	84	<MRL	<MRL	<MRL
Pond 2A	24.8	98	74.8	35.7	0.290	116	3.4	142	<MRL	<MRL	4.28
Pond 3	18.1	74	40.8	25.2	0.258	65.1	3.2	79	<MRL	<MRL	1.30
Pond 4	5.78	22	10.1	10.4	0.048	28.8	0.98	25	<MRL	<MRL	2.45
Pond 5	18.7	63	39.2	28.6	0.110	64.4	2.1	71	<MRL	<MRL	7.04
Pond 6	9.85	46	18.2	15.8	0.062	51.4	1.1	49	<MRL	<MRL	2.09
Pond 6A	11.5	58	29.0	21.7	0.170	67.0	1.5	61	<MRL	<MRL	<MRL
Pond 7	10.4	38	12.9	8.50	0.027	29.6	1.2	343	<MRL	- -	<MRL
Pond 7A	15.2	59	27.0	15.6	0.069	90.0	1.1	66	<MRL	<MRL	6.22
Pond 8	8.3	45	18.3	6.30	0.067	30.9	1.3	32	<MRL	<MRL	<MRL

1 Average of measurements at each salt pond.

2 Sources: Napa River and San Pablo Bay values calculated from San Francisco Estuary Institute data (URL:/ www.sfei.org/rmp/data.htm), salt pond data from Hydroscience 2002.

3 Total PCBs concentration data from salt ponds were all below method reporting limit (MRL), which varied from 3.9 to 56 µg/kg.

4 Total PAHs data from majority of salt ponds were below MRL, which varied considerably. The symbol (--) indicates individual PAH isomers (fluoranthene and/or pyrene) were detected in single samples from ponds 1 and 7; however, a total PAHs value is not available.

5 Total DDTs data from salt ponds were below MRL, which varied from 1.68 to 24.5 µg/kg.

Sediment

RMP monitoring data for 1993–1999 average sediment constituent concentrations in the Napa River and San Pablo Bay are shown in Table 4-6. The data indicate that both water bodies exceed one or more guidance criteria (refer to table 4-3) for arsenic, chromium, copper, mercury, nickel, and total dichlorodiphenyltrichloroethane isomers (DDTs) (San Francisco Estuary Institute 1999, 2000a). RMP data for the Napa River indicate that mercury, PCBs, total DDTs, arsenic, copper, and chromium exceeded sediment guidelines in more than 90% of the samples collected from 1993 to 1999 (San Francisco Estuary Institute 2000a). San Pablo Bay sediment also exceeds criteria for total PAHs. The former Mare Island Naval Shipyard is also a potential point source of TBT, a highly toxic endocrine-disrupting chemical used as an antifoulant in ship paints. Sediment toxicity tests have also frequently been positive for Napa River samples; Davis Point samples have tested positive for sediment toxicity much less frequently.

Mercury Dynamics in an Estuary

Mercury contamination is widespread in sediments and waters of the San Francisco Bay area (San Francisco Estuary Institute 2000a, San Francisco Bay RWQCB 2000). Mercury is a constituent of particular concern to wetland restoration projects because of its ability to convert to the methylated form of the metal, which is relatively more mobile in the aquatic environment than other forms. Long-term RMP monitoring data for total mercury in water and sediment has consistently shown elevated concentrations, primarily in the north and south bay areas and river tributaries. There is also a strong correlation between total mercury and suspended sediment transport in the water (U.S. Geological Survey 2000c). Figure 4-5 shows the continuous TSS data and calculated mercury concentrations that would be expected at Point San Pablo, based on their known correlation relationship.

Elevated mercury levels are in large part a legacy of the California gold mining era, when mercury was used in the gold refining process. Mines such as south San Francisco Bay’s New Almaden Mine, which operated for many years in the upper Guadalupe River watershed extracting the mercury ore cinnabar, are known to be a source of mercury in the bay system. Over time, leaching of mine tailings and overland transport of mercury-bearing sediments have resulted in the downstream accumulation of mercury in the watershed. Mercury is also delivered to the San Pablo Bay system via the Delta.

In aquatic environments, most mercury is chemically bound to suspended particles of soil or sediment; a smaller fraction is bound to dissolved organic carbon. Sediment-bound mercury may be available to aquatic organisms and is thus a pollutant of concern; the potential for adverse environmental effects from sediment-bound mercury depends primarily on transport and depositional characteristics (e.g., particle size) and on the physical and chemical properties of the sediment.

Additionally, sediment-bound mercury may be converted through both biotic and abiotic processes to its more bioavailable methylated form. Factors conducive to methylation of mercury include low-flow or stagnant waters, hypoxic or anoxic conditions in the water or sediment column, low pH (pH<6), and high concentrations of dissolved carbon. Most of these factors are in turn affected by biological processes such as metabolism, growth, and decay; for example, mercury methylation has been linked to the activity of sulfate-reducing bacteria in the shallow anoxic sediment column.

Aquatic plants, fish, and wildlife readily adsorb methyl mercury. It can then accumulate in their tissues, creating contaminated food sources (plant or animal tissues) that transfer through the food web (Santa Clara Valley Water District and U.S. Army Corps of Engineers 2001). It is a mutagen, teratogen, and carcinogen, and has embryotoxicological, cytochemical, and histopathological effects. In aquatic organisms, concentrations of 0.1–200 µg/l have been shown to produce adverse effects; toxicity increases with age of the organism, exposure time, temperature, lowered salinities, and the presence of other metals.

4.1.3.4 Treatment Plant Discharge

WWTPs are monitored as point sources of pollution, and most plants in the north bay region are converting to tertiary treatment to meet increasingly stringent discharge permit requirements. The WWTPs in the north bay region discharge recycled water to area waterways only during the wet season. The SVCSD WWTP discharges to Schell Slough, the NSD WWTP discharges to the Napa River 14 miles upstream from the confluence with San Pablo Bay (downstream of Carquinez Strait), and the CAC WWTP discharges into the North Slough and adjacent constructed wetlands.

Table 4-7 shows effluent data from selected north bay WWTPs that may consider participating in the restoration of the Napa River Unit. In general, the WWTPs produce effluent that has moderate inorganic mineral content with low suspended solids and turbidity relative to the natural background conditions in the Napa River and San Pablo Bay. The pH values are neutral, and along with ammonia and whole effluent toxicity test data, the effluent usually is in compliance with regulatory permit limits.

High analytical detection limits used for some of the trace metals preclude comparisons with applicable Basin Plan water quality objectives (refer to Table 4-2). However, NSD and City of Petaluma effluent discharges generally contain low levels of copper and mercury, which are listed on the 303(d) list as substances responsible for the impairment of San Pablo Bay. Novato SD and LGVSD discharges have elevated copper and mercury concentrations. These substances are considered in the NPDES permits issued by the San Francisco Bay RWQCB, although the allowable discharge levels could change when the TMDL process is complete. The City of Petaluma and LGVSD WWTP data also indicate that zinc concentrations are periodically elevated relative to Basin Plan water quality objectives.

4.1.4 Project Setting

The project area of interest with regard to water quality issues is primarily defined as the salt ponds, adjacent sloughs, immediately adjacent Napa River area, and northern San Pablo Bay. Salinities of water in the salt ponds undergoing evaporative concentration are significantly higher than those in nearby San Francisco Bay waters. The processes that affect the transport of sediment, salts, and other water quality constituents in adjacent waterways are complex and driven by asymmetric tidal systems to the east and west of the pond system producing a barotropic convergence zone within the slough system. In addition, the transport process is strongly affected by the baroclinic convergence zone created by the phase difference between the two deep tidal channels, Mare Island and the Carquinez Strait. This complex process is a function of density differences between waters of variable salinity and tidal action and is related to the timing of salinity pulses in the Napa River, San Pablo Bay, and Mare Island Strait/Carquinez Strait junction.

The amount of data regarding chemical constituents in the nearby receiving waters, pond waters, and pond sediments is limited. Two baseline studies of inorganic constituents and the variation that occurs in the ponds have been conducted in recent years (Takekawa et al. 2000, Warner et al. 1999). The Coastal Conservancy contracted with Hydroscience Engineers (2002) and PWA to collect water and sediment grab samples in September 2001 in all of the ponds; the data are described below and are shown in Tables 4-5, 4-6, and 4-8.

4.1.4.1 Salinity in Pond Water

The salinity patterns in the salt ponds have been extensively described in Chapter 2, “Site Description and Options.” Table 4-8 also shows the average total dissolved solids (TDS) and chloride concentrations in pond water based on grab samples (Hydroscience Engineers 2002). Salinity levels in the salt ponds depend on inflows to the ponds and water management procedures implemented currently by DFG, baroclinic influences, evaporation, precipitation, and runoff.

Salinity records indicate a general trend of increasing salinity in the sloughs toward the southwest of the project area as the influence of the Napa River declines and the influence of San Pablo Bay increases. This trend is reinforced seasonally as Napa River flows decline in summer. Another general trend may be caused by the influence of waters discharging from the Delta through the Carquinez Strait, which produces an increasing salinity gradient toward the west of the project area as the fresh water moves into San Pablo Bay.

Salinity in the Napa River varies daily because of diurnal tidal influence from San Pablo Bay and seasonally as a result of changes in freshwater runoff. Daily fluctuations are on the order of 5 ppt; seasonal variations are on the order of 20 ppt (from completely fresh water during high spring runoff to heavy seawater

Table 4-7. Summary of Representative Effluent Constituent Concentrations in Wastewater Treatment Plants

Constituent	Napa (year 2000)			Petaluma (year 2000)			Novato (year 1999)			Las Gallinas (year 2000)			Sonoma (year 2001)		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min.	Max.	Avg.
Temperature (C)	12.4	22.3	17.0	ND	ND	ND	14	26	20	16	19	17	18.5	22.7	20.9
BOD (mg/l)	8	22	14.6	14.3	25	18.4	3	41	8	5.5	11.3	8.3	<5	9.5	5.5
TSS (mg/l)	10	22	16	2.4	64.6	44.5	2	19	6	8.6	32	14.4	2.1	6.4	3.7
pH	6.9	7.9	7.6	7.31	7.62	7.46	7.0	8.3	7.6	6.9	7.5	7.2	6.5	6.9	6.6
Ammonia (mg/l)	ND	ND	ND	1.6	15	9.1	0.9	6.6	2.9	0.1	2.8	1.2	0.25	0.47	0.33
Turbidity (NTU)	0.9	11.1	4.9	12.7	43.7	26.9	2	24	10	ND	ND	ND	1.3	3.0	2.2
Toxicity, % survival	25	100	88	95	100	99	ND	ND	ND	97	100	ND	84	100	96
Chlorophyll (µg/l)	ND	ND	ND	143	300	221	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic (µg/l)	<2	<2667	<270	<2	3	2.08	<2	3	ND	<2	<2	<2	<2	<2	<2
Cadmium (µg/l)	<0.2	<0.2	<0.2	<2	<2	<2	<0.2	<0.2	ND	<1	<2	<2	<1	<1	<1
Chromium, total (µg/l)	<1	<2	<1	<1	4	1.5	<2	12.8	ND	<1	1.5	<1.2	<2	<2	<2
Copper (µg/l)	0	<15	<4	<2	3.5	2.38	7	15	ND	7	13	9.7	7.1	10.8	8.9
Cyanide	<3	<3	<3	<3	6	4.3	<3	<3	ND	<3	7	<4	<6	<6	<6
Lead (µg/l)	<2	<2	<2	<2	<2	<2	<2	3	ND	<2	<2	<2	<2	<2	<2
Mercury (µg/l)	<0.00005	<.007	<.00173	0.00421	0.0103	0.0063	0.02	0.10	ND	0.024	0.050	0.034	0.0034	0.0076	0.0053
Nickel (µg/l)	<2.2	<3	<3	<3	27	6.69	<5	17	ND	<3	5	3.9	3	3	3
Selenium (µg/l)	<1	<20	<2	<1	<1	<1	<1	<1	ND	<1	1	<1	<5	<5	<5
Silver (µg/l)	<0	<0	<0	<0.5	<0.5	<0.5	0.8	1.6	ND	<0.5	1.1	0.9	<2	<2	<2
Zinc (µg/l)	<4	<34	<20	<20	40	23.1	23	38	ND	60	110	85	49.75	68.83	58.83
Phenols (µg/l)	<5	<20	<8	ND	ND	ND	<5	5	ND	<5	10	7	ND	ND	ND
PAHs	<5	<20	<8	<0.3	<0.3	<0.3	<MRL	<MRL	ND	<MRL	<MRL	<MRL	ND	ND	ND

Notes:

BOD = biological oxygen demand
µg/l = micrograms per liter
mg/l = milligrams per liter
MRL = method reporting limit
ND = no data available
NTU = nephelometric turbidity units
PAH = polycyclic aromatic hydrocarbon

No data available from CAC WWTP at this time.

Table 4-8. Average Concentrations of Conventional and Trace Metal Constituents in the Salt Pond Water Samples

Parameter (units)	Pond 1	Pond 1A	Pond 2	Pond 2A	Pond 3	Pond 4	Pond 5	Pond 6	Pond 6A	Pond 7	Pond 7A	Pond 8
Ammonia (mg/l N)	0.25	0.32	0.25	0.40	0.23	3.38	3.63	0.32	0.24	39.5	0.34	128
Nitrate (mg/l N)	0.7	0.6	0.5	0.3	2.0	6.0	6.2	3.4	1.2	6.4	2.0	1.0
TKN (mg/l N)	2.8	4.2	4.4	1.3	12.4	55.2	59.9	7.0	5.4	111	12.2	130
pH	8.4	9.1	8.9	7.9	8.3	7.7	7.6	8.4	8.8	5.0	8.6	3.3
BOD (mg/l)	4.9	26.7	11.5	1.5	28.7	15.9	4.1	8.7	8.8	44.6	48.4	29.3
Turbidity (NTU)	9.5	23.6	29.2	7.2	59.4	92.0	83.2	12.2	19.6	145	46.5	36.3
TSS (mg/l)	62	47	ND	ND	168	444	533	31	53	354	84	102
TDS (mg/l)	40,050	164,000	38,430	21,850	66,480	323,000	323,700	92,100	57,530	353,500	96,400	293,700
Chloride (mg/l)	22,900	33,600	22,250	12,000	38,900	174,500	173,700	54,200	32,200	226,000	53,300	150,700

Notes:

N = Nitrogen
TKN = total Kjeldahl nitrogen
BOD = biochemical oxygen demand
NTU = nephelometric turbidity units
TSS = total suspended solids
TDS = total dissolved solids
ND = none detected

Table 4-9. Average Concentrations of Conventional Constituents in the Salt Pond Sediment Samples

Parameter (units)	Pond 1	Pond 1A	Pond 2	Pond 2A	Pond 3	Pond 4	Pond 5	Pond 6	Pond 6A	Pond 7	Pond 7A	Pond 8
Inorganic constituents and trace metals												
pH	7.70	8.25	7.70	6.95	8.13	7.73	7.85	7.87	7.47	6.87	7.30	5.97
Total phosphorus (mg/kg)	124	114	87.8	340	242	182	205	150	257	64.0	183	57.3
Chloride (mg/kg)	21,300	53,300	22,100	20,100	43,200	308,000	176,500	129,300	54,870	219,300	83,100	170,300
Organic nitrogen (mg/kg)	1,855	3,140	2,012	3,165	2,278	2,845	5,430	3,270	4,798	2,003	4,797	1,393
Total solids (%)	43.4	35.8	46.4	37.3	48.2	48.5	45.3	39.8	41.6	58.9	44.6	57.6
Sodium (mg/kg)	17,600	34,800	17,800	15,100	28,800	172,500	73,450	70,850	33,700	73,200	49,400	54,700
Potassium (mg/kg)	5,965	6,780	6,060	5,225	5,880	4,803	6,815	5,648	5,293	9,757	5,697	12,000

Notes:
mg/kg = milligrams per kilogram; µg/kg = micrograms per kilogram.

influences during the dry season). Salinity in San Pablo Bay in the vicinity of the salt ponds may vary by as much as 10 ppt seasonally, with the salinity level in a small near-shore area having the potential to become freshwater (0 ppt) during heavy rainfall periods.

4.1.4.2 Temperature, Dissolved Oxygen, and pH

Water temperature is an important physical parameter that affects the metabolic rate of aquatic organisms, tolerance of aquatic organisms to other environmental stressors, and other physical and chemical water quality processes. The solubility of dissolved oxygen (DO) in water is a direct function of water temperature, with maximum possible DO values being lower at higher water temperatures. The most extensive information for conventional constituents of concern in the salt ponds comes from recent data collected with continuous monitoring equipment for temperature, DO, pH, and turbidity (Takekawa et al. 2000). The maximum recorded temperature in the salt ponds was 30ºC in August and the minimum was 7ºC in February. DO concentrations were generally lowest in Ponds 4 and 7; however, DO in these ponds ranged from a relatively low value of 0.6 mg/l to as much as 7.0 mg/l, which can still sustain aquatic life. Average DO concentrations were slightly higher in Ponds 2, 2A, and 3. The highest overall DO concentration conditions were recorded in Pond 1 and ranged from 7 to 12 mg/l. Seasonal patterns in the DO concentrations were evident with generally lower values in the summer and higher values in the winter.

The pH values (a measure of acidity) generally vary considerably among the ponds and are generally within the Basin Plan objectives of 6.5 to 8.5 (refer to Table 4-8). Extremely low pH values were measured in Pond 8 (2.9–3.2), indicating strongly acidic conditions. However, conditions in Pond 8 typically exhibit a seasonal pattern with higher levels of approximately pH 5 when more water is present. Low pH values also occurred in Pond 7 (4.4–5.1). Seasonally, pH values were generally lower from September through November and higher in the early spring.

4.1.4.3 Nutrients, Suspended Sediment, and Turbidity in Pond Water

Ammonia, nitrate, and total Kjeldahl nitrogen values measured in 2001 (Table 4-8) indicate that Ponds 4, 5, 7, and 8 have the highest concentrations of these plant nutrients. Nitrogen and phosphorus are primary nutrients necessary for growth of algae and aquatic vascular plants. However, there are no monitoring data for the existing rates of algae or plant growth in the ponds.

Takekawa et al. (2000) found turbidity to be highest in Pond 1, ranging from 200 to 800 NTU. Turbidity is known to be associated with wind and wave agitation that results in the resuspension of precipitated salts from the sediment surface. Turbidity varied widely in Ponds 2, 2A, 3, 4, and 7 from 20 to 250 NTU. Turbidity was relatively constant in Pond 2A, from 50 to 110 NTU. The 2001 data shown in Table 4-5 indicate that Ponds 4, 5, and 7 had the highest turbidity and TSS values. TSS concentrations in the typical tributary sloughs to San Pablo Bay and the Napa River generally decrease with increasing distance from San Pablo Bay, ranging from 41 mg/l to 386 mg/l (Warner et al. 1999).

4.1.4.4 Trace Metals and Organic Compounds in Pond Water

The 2001 sample results shown in Table 4-5 represent the most complete characterization of trace metal and organic compound concentrations in the ponds. It should be noted that single samples where detection did not occur (i.e., cadmium, lead, mercury, nickel, and silver) cannot be compared with Basin Plan and CTR water quality criteria because the laboratory detection limits were higher than the criteria. In addition, the effect of evaporative concentration on contaminant concentrations has not been evaluated. Evaporative concentration and associated lower volumes of water in the ponds during dry conditions may increase the concentrations of soluble constituents. When the ponds contain more water input from rainfall, the concentrations may be lower as a result of increased available dilution capacity. However, each pond had at least one calculated average concentration of arsenic, copper, lead, nickel, selenium, silver, or zinc that exceeded applicable criteria. With the exception of Ponds 6 and 6A, copper concentrations exceeded criteria in all of the ponds. Zinc was also elevated in all ponds except 1/1A, 2/2A, 6A, and 7A. Overall, Pond 7 had exceedances of the criteria for the most constituents including copper, nickel, selenium, silver, and zinc. All other ponds only exceeded criteria for one or two metals. In general, pond water concentrations of arsenic, copper, and zinc were substantially higher than comparable values in the Napa River or San Pablo Bay.

4.1.4.5 Toxicity of Pond 7 Bittern and Brine Mixtures

Chronic aquatic toxicity testes (7-day) were conducted in 2002 (Pacific EcoRisk 2002) using *Americamysis bahia* (mysid), which was the most sensitive species in previous testing on Pond 7 samples conducted in 1990. The 2002 toxicity test results were summarized and compared to available literature information regarding potential toxicity mechanisms in highly saline brines (Gaia Consulting 2002). Pond 7 bittern and Pond 8 hypersaline brine samples were collected on May 14, 2002 for the study. Four mixtures with the following bittern and brine ratios were created: 100% bittern/0% brine, 70% bittern/30% brine, 40% bittern/60% brine, and 10% bittern/90% brine. Each of the four test mixtures were diluted to test concentrations of 0.25%, 0.5%, 1%, 2.5%, 5% and 10% with saline dilution water having 20 ppt salinity. Toxicity tests were evaluated for both survival and growth endpoints.

Results from the toxicity tests with the four different mixtures showed that mysid survival rates exceeded 80% for all four of the test mixtures up to and including the 5% dilution test; survival for all of these tests were not significantly less than the laboratory control. Survival was 0% at the 10% dilution in all four test mixtures except the 10% bittern/90% brine mixture which had significantly lower survival than the laboratory control. Mysid biomass was also not significantly less than the control for dilutions up to and including 5%, except for Mixture 1 which contained 100% Bittern. For Mixture 1, the biomass was significantly less than the control at the 5% dilution.

Gaia Consulting (2002) reached two primary conclusions regarding the test results: 1) diluting the bittern with hypersaline brine does not appear to significantly increase the rate at which bittern could be discharged, and 2) the apparent toxicity of bittern in this study is lower than that found in prior studies, suggesting that higher discharge rates may be acceptable. These results differ from the previous bittern testing performed for the Napa Ponds in 1990 which showed that only dilutions of 1% to 1.5% bittern had a mean survival rate that was not significantly lower than the control treatment. During previous studies, complete mortality was noted at a 5% bittern solution. The precise salinity of the bittern used in these previous studies is not known, however, it is likely that the concentration was considerably higher (between 390 and 450 g/kg) than the recent testing because the bittern samples were collected shortly after salt production ceased. Because a variety of organisms were previously tested in 1990, and more tests were conducted, the prior testing effort still provides the baseline for bittern discharge criteria. Gaia Consulting concluded that additional testing is required to confirm the findings of the 1990 investigation and determine whether increased discharge rates for the bittern are possible.

4.1.4.6 Constituents in Pond Sediments

The sediment samples collected in 2001 represent the only data set for characterization of conventional (Table 4-9) and trace metal and organic compound concentrations (Table 4-6) in the pond sediments. The pond sediments have relatively uniform percent solids composition ranging from 36% to 58% solids, indicating a moderate organic matter content (refer to Table 4-9). The organic nitrogen content is considerable and phosphorus content is relatively low. Analysis for chloride indicates that all of the ponds have elevated salt content within the sediment structures.

Five sediment surface grab samples were collected and analyzed for total salinity content from Pond 7 (2 samples in March 2002 and 3 samples in May 2002) and three sediment samples were collected from Pond 8 in May 2002 (Gaia Consulting 2002). The sediment cores were generally about 7 to 12 inches long and consisted of dark brown silty sand. There was a salt crust approximately ¼-inch thick on the sediment surface of both ponds. Replicate pond brine samples were collected from the ponds at the same time as the sediment samples. Sediment salinity was determined by repeatedly extracting the samples with water to remove all soluble compounds. The data indicate that the salt content of the near surface sediment contains a lower mass of the total pond salt content than brine overlying the sediment. Sediment salinities ranged from 67 g/kg to 99 g/kg for Pond 7, and from 64 g/kg to 110 g/kg for Pond 8. Brine salinities at Pond 7 were 300 g/kg and 310 g/kg for April 19 and May 14, respectively.

Salinities at Pond 8 were 140 g/kg and 190 g/kg on May 1 and May 14, respectively.

Pond sediment concentrations of specific trace metals and organic compounds compared closely with values measured in the Napa River and San Pablo Bay with differences generally being less than 50% of each other. There are no long-term geochemical cycling data available with which to evaluate the factors associated with the differences. Average selenium concentration values in the ponds are consistently higher than the respective Napa River and San Pablo Bay values. Concentrations of the majority of constituents in Ponds 4, 5, 6, 6A, 7, 7A, and 8 all appear to be slightly lower than concentrations in the Napa River or San Pablo Bay. Concentrations of constituents in Ponds 1 through 3 are similar or slightly higher than in the Napa River or San Pablo Bay. The detection limits for total PCBs, PAHs, and DDTs used for the pond samples were elevated relative to the criteria, so comparisons with the historical Napa River and San Pablo Bay data are only possible where detections occurred.

Analyses indicate the majority of pond sediments have relatively elevated selenium and total DDT content relative to the San Francisco Bay RWQCB sediment screening criteria for wetland noncover applications. Average concentrations of selenium exceeded the wetland noncover screening criteria in Ponds 2A, 3, 5, and 6A and single sediment sample values from Ponds 1, 1A, and 7A also exceeded the criteria, indicating that these sediments exceed criteria for use in wetland environments. The average concentration of zinc measured in Pond 7 also exceeded the wetland noncover screening criterion. The number of individual organic compounds detected and their measured concentrations were relatively low, with the exception of total DDT compounds. Average concentrations of total DDT did not exceed wetland noncover criteria. However, average DDT values did exceed the wetland cover criteria in Ponds 2A, 5, and 7A indicating that these sediments would be classified as being suitable only for wetland noncover uses. The average DDT values also exceeded the ER-L criteria in all ponds where detections occurred (Ponds 1, 2A, 4, 5, 6, and 7A) with the exception of Pond 3. However, DDT concentrations at the Napa River and San Pablo Bay sites also exceeded the wetland cover and ER-L criteria for DDT and indicate a regional presence of these compounds in the sediments. There were no pond average concentrations of mercury exceeding the either wetland use criteria; however, single sediment samples in Ponds 1 and 3 exceeded the wetland cover criteria. Average mercury values also exceeded the ER-L criteria in Ponds 1, 1A, 2A, 3, and 6A. Average arsenic values exceeded the ER-L criteria in all ponds except Pond 4.

4.1.4.7 Treatment Plant Discharge

SVCSD currently produces disinfected secondary treatment water, but plans are underway to upgrade the WWTP to tertiary treatment by summer 2004. SVCSD discharges water to Schell Slough during the wet season and stores water during the dry season for agricultural irrigation and environmental use. SVCSD created the Schell Slough Mitigation and Enhancement Wetland Area for constructing dry-season storage. During September and October, SVCSD provides secondary treated wastewater to flood these wetlands for winter habitat. If the project is implemented, SVCSD must continue to provide water to the wetlands and its current agricultural customers.

During the wet season, NSD produces secondary treated wastewater and discharges that water into the Napa River. Discharge into the Napa River is prohibited during the dry season, so NSD either puts the water through an additional filtration process to produce tertiary treated recycled water for reuse or stores it in holding ponds until the wet season when it can be discharged into the Napa River.

CAC WWTP discharged via NSD prior to becoming permitted by the San Francisco RWQCB in the fall of 2002. Now, CAC WWTP produces tertiary treated wastewater and discharges to North Slough, a constructed wetland on North Slough, or to recycled water customers.

4.2 Environmental Impacts and Mitigation Measures

4.2.1 Methodology and Significance Criteria

The potential effects of habitat restoration on local and regional water quality were assessed qualitatively and quantitatively, based on a comparison between existing conditions, project construction, and projected postrestoration conditions with respect to

- temporary construction-related water quality impacts;
- project operations impacts (temporary and long-term changes to water and sediment quality within the salt ponds, Napa River, San Pablo Bay, and other water bodies that may be affected); and
- constituents of concern including temperature, salinity, suspended solids and turbidity, organic matter, nutrients and dissolved oxygen, inorganic and organic contaminants, and sedimentation.

Similarly, the potential effects of the Water Delivery Option were assessed qualitatively based on a comparison of existing conditions, project construction, and postproject conditions with respect to the issues identified above.

Preliminary 1-D numeric modeling has been conducted and results are available to identify the potential water quality changes in the ponds, Napa River, and San Pablo Bay associated with some of the restoration strategies. In addition, a 2-D model is being developed to specifically design restoration strategies that ensure adequate mixing and dilution of salts in the receiving waters. Results from the 2-D model are expected by early 2003. The analysis is generally qualitative with appropriate mitigation measures used to ensure that final project designs protect water resources. Final project designs would be developed in conjunction with these modeling efforts.

Criteria based on the CEQA Guidelines were used to determine the significance of water quality impacts. The project would have a significant impact on water quality if it would

- violate any water quality standards or waste discharge requirements, or
- substantially degrade water quality.

4.2.2 No-Project Alternative

4.2.2.1 Impact WQ-1: Long-Term Potential for Discharge of Contaminants to Adjacent Surface Water

Under the No-Project Alternative, the salt ponds would continue to be managed in their current state by DFG. Ponds 4, 5, 7, and 8 would continue to contain large amounts of dissolved and precipitated salts. Pond 7 in particular would continue to have a large residual mass of bittern and associated deposits of precipitated chemicals as the surface layer of the pond sediments. Because the San Francisco Bay region is in a seismically active area, the pond levees could catastrophically fail or the ponds could be inundated as a result of seismically induced seiche or tsunami, causing a large discharge of contaminants into the Napa River (as described in Chapter 8, “Geology and Soils”).

It is also presumed that long-term exposure of levees to flooding and wave action, in combination with limited levee maintenance, would eventually result in levee failures. The resulting discharge would most likely result in substantial impairment of water quality in the form of a large and rapid increase in the concentrations of salinity, suspended sediment, and other contaminants. Depending on the location of levee breaches, water quality impacts could occur within the local sloughs, Napa River, and/or San Pablo Bay. Continual erosion or catostrophic destruction of the upper ponds could cause severe water quality impacts to adjacent Napa Slough because these ponds contain large amounts of salt and bittern that could be released, and the slough is small which limits tidal water exchange and dilution of potential discharges compared to the much larger Napa River channel.

The duration of the impaired water quality and magnitude and extent of beneficial use impact on the aquatic ecosystem of the Napa River and San Francisco Bay is difficult to forecast. PWA’s hydrodynamic model was used to evaluate potential salinity effects resulting from levee breaches and inundation occurring in Ponds 3 and 4 during high streamflow conditions in the Napa River. The data indicate that salinity at the breach would increase by up to 18 ppt during the first 24 hours. The maximum salinity increase would drop to approximately 12 ppt the second day. The near-field plume in the Napa River, where salinity would increase by more than 5 ppt as a result of this discharge, would last for about 2 weeks. Because the 1-D modeling assumes complete mixing within the Napa River, salinity could increase to a greater extent near the 50-foot wide levee breach in the mixing zone of pond water and Napa River water than indicated by the modeling results. No modeling was conducted for levee breaches at Ponds 7, 7A, or 8, where substantially higher salt concentrations exist.

In general, the magnitude of modeled changes in salinity in the Napa River is within the seasonal range of salinity changes that naturally occur in the estuary. However, if a catastrophic breach were to occur during a period when sensitive life stages of aquatic organisms were present, salinity changes within the Napa River could cause substantial adverse water quality impacts. Uncontrolled levee breaches along the upper ponds would also have greater impacts than similar breaches along the lower ponds because of the much higher salinity and bittern content that would be discharged to receiving water. While unlikely, a catastrophic breach during the summer low-flow period when minimal freshwater dilution is available would also have greater impacts than modeled.

USGS started monitoring salinity and other water quality parameters soon after the ditches were created on Pond 3, collecting data within the pond and outside the ditches. Initial salinity within the sloughs was approximately 20 parts per thousand (ppt) and within the pond was approximately 60 ppt. Pond salinity was still near 60 ppt and the ditches are having a very slow effect on salinity. No change in the salinity in the sloughs was initially detected within 5-20 feet of the ditches. In December 2002, after approximately 13 inches of rain and 3 months of tidal cycles, salinity in Pond 3 along a transect between the two ditches was approximately 12 ppt. Additional monitoring and sampling is planned for 2003.

However, catastrophic breaches of the ponds, particularly the upper ponds as described above, could result in water quality changes that would most likely exceed San Francisco Bay RWQCB thresholds for adverse impacts on beneficial uses of the receiving water; therefore, this impact is considered significant. However, this alternative would result in no project being implemented; therefore, no mitigation is required.

4.2.3 Salinity Reduction Option 1A: Napa River and Napa Slough Discharge

4.2.3.1 Impact WQ-2: Short-Term Construction-Related Water Quality Impacts

Construction activities may cause temporary water quality impairment because disturbed and eroded soil, petroleum products, and miscellaneous wastes could be discharged to nearby water and/or drainage channels. If allowed to occur when sensitive organisms are present, discharges of soil and associated contaminants can cause adverse changes in turbidity, aquatic habitat sedimentation, or exposure to toxic substances. Construction materials such as fuels, oils, paints, and concrete are potentially harmful to fish and other aquatic life.

The extent of potential environmental impacts depends on the erodibility of soil types encountered, type of construction practices, extent of disturbed area, duration of construction activities, timing of precipitation, and proximity to drainage channels. Construction during the winter rainfall season can also be problematic because of the increased potential for discharges of contaminated stormwater runoff from construction sites.

This option may also include the component of using recycled water from the NSD and SVCSD WWTPs for additional dilution water in the mixing chamber at the upper ponds (7, 7A, and 8). See Section 4.2.7, “Water Delivery Option,” for specific details of the potential construction-related impacts.

Discharge of contaminated stormwater constitutes a violation of the Basin Plan water quality objectives; therefore, this impact is considered significant. Implementation of Mitigation Measure WQ-1 would reduce this impact to a less-than-significant level.

Mitigation Measure WQ-1: Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices

The project sponsors will obtain authorization from the San Francisco Bay RWQCB to construct proposed elements of the project. As part of this application, the project sponsors will prepare a SWPPP and require all construction contractors to implement BMPs identified in the SWPPP for controlling soil erosion and discharges of other construction-related contaminants such as fuel, oil, grease, paint, concrete, and other hazardous materials. Routine monitoring and inspection of BMPs will be conducted to ensure that the quality of stormwater discharges is in compliance with the permit. Construction will be limited to the dry weather season to the maximum extent possible. The SWPPP will be prepared prior to the start of construction activities and prescribe site-specific implementation of BMPs to avoid and reduce waste discharges. The SWPPP will include BMPs that address the following general categories of erosion and runoff control:

- soil stabilization measures, such as preservation of existing vegetation and use of mulch or temporary plantings 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;

- nonstormwater discharge control measures, such as monitoring water quality of dewatering operations and 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 BCDC's bay dredge guidance documents. These 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.

4.2.3.2 Impact WQ-3: Increase in Salinity in the Napa River

The project is specifically designed to introduce low-salinity water into the salt ponds to reduce the amount of accumulated salts in the ponds to manageable levels through tidal water exchange and dilution of the higher salinity water. The project would result in temporary discharges of accumulated salts into project area sloughs and the Napa River. Preliminary modeling indicates that dilution of the ponds to the objective levels could be achieved relatively quickly (within 24 months) for Ponds 3, 4/5, and 6/6A, but may take longer (3–4 years) depending on the actual rate of salt dilution achieved with the proposed modifications. Modeling of salinity reduction for the existing water in Ponds 7, 7A, and 8 indicates that complete salinity reduction to ambient concentrations may take 30–50 years. Careful management of releases from the upper ponds because of their chemical content (high salinity, low pH, ion-specific characteristics of bittern) is also important for ensuring the avoidance of adverse impacts on aquatic habitat and organisms. Adverse water quality impacts could occur as a result of releases from the upper ponds if there is insufficient dilution capacity within the sloughs and the Napa River. Salinity could also continue to be generated as a result of resuspension and dissolving of encrusted salts that currently reside in sediment layers in the upper ponds.

During typical high winter streamflow conditions, the maximum salinity increase in the Napa River and the sloughs is expected to be small because of the low-salinity receiving water and large dilution capacity. Salinity reduction in the ponds during the summer low-flow season would have a greater potential to cause water quality impacts on receiving waters because the dilution capacity would be reduced compared to the winter season. Figures 4-6 and 4-7 show simulated average daily salinity in the Napa River for preproject conditions and for project components, showing that salinity reduction can be completed over approximately 24 months (Philip Williams and Associates 2002b). Figure 4-6 shows salinity in the Napa River during the period when salinity is reduced in Pond 3. Salinity increases by a maximum of about 5 ppt, with most changes less than 1 ppt. Figure 4-7 shows the maximum potential salinity changes during the period when Pond 4 outlets are operated and salinity is reduced in Ponds 5 and 6/6A. Average salinity increases by a maximum of about 3–5 ppt within the first 4 months, with changes dropping to less than 1 ppt after 4 months. Figure 4-8 shows simulated receiving water changes in Napa Slough resulting from discharges from the upper ponds through the mixing chamber. The data indicate that maximum salinity increases would be about 2–3 ppt. These simulated changes are less than the existing normal range of ambient salinity changes that can occur in the lower Napa River at any given time. However, during the period when salinity reduction is occurring, the frequency of salinity increases in receiving waters would be greater compared to current conditions because salinity levels in pond discharges would be elevated compared to conditions in the river and sloughs.

Over the long term, receiving water impacts from salinity reduction in the ponds would cease because the saline water in the ponds would be diluted and the ponds would eventually accrete with sediment and vegetation and revert to tidal marsh with ambient salinity regimes that are typical of the natural San Francisco Bay area wetlands.

The potential salinity changes in the Napa River and sloughs are a significant issue with regulatory agencies for beneficial use attainment, and long-term compliance with the Basin Plan objectives. Water quality objectives could be exceeded; therefore, this impact is considered significant. Implementation of Mitigation Measure WQ-2 would reduce this impact to a less-than-significant level.

Mitigation Measure WQ-2: Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring

The project sponsors will design the project so that the timing of construction and the potential salinity impacts on the Napa River and sloughs resulting from project-related discharges will comply with WDRs issued by the San Francisco Bay RWQCB and stipulations imposed by other resource agencies (e.g., NMFS, USFWS). It is anticipated that WDRs issued by the San Francisco Bay RWQCB will require that discharges meet stringent water quality limits in the receiving waters for salinity, temperature, DO, and contaminant loads. The rate of project-related discharges of high salinity water may also need to be controlled under certain conditions to ensure that the water quality conditions in receiving waters are not impaired.

In general, project facilities will be constructed with the following design features and ongoing water quality monitoring to protect the aquatic resources of the Napa River and sloughs and maintain compliance with applicable project permit conditions.

- The near-field mixing modeling will be completed to aid in the design of effective outfall diffusers in the sloughs and Napa River to ensure rapid and complete mixing of the discharges into the receiving water.
- Modeling will also be used to develop a restoration design of the facilities needed to effectively reduce the highly saline and bittern waters that are present in the upper ponds.
- Tests will be conducted on precipitated salts within pond sediments to identify the rate at which they may dissolve when exposed to less saline water. This information will be used to refine the modeling of long-term salinity reduction scenarios for ponds that have encrusted salts in the sediment.
- Flow control structures that allow passage of water between the salt ponds and provide for discharge of salts to the Napa River or sloughs will be controlled in accordance with modeling parameters. Water flow into, within, and from the salt ponds will be carefully monitored for salinity to ensure that the salinity reduction is proceeding according to the established design parameters.

A comprehensive water quality monitoring program will be prepared and implemented for the duration of the salinity reduction process by the project sponsors in conjunction with the overall operations and maintenance program for the ponds. The monitoring program will have well-defined data quality objectives, monitoring procedures, and data analysis and reporting protocols to ensure that project operations are controlled according to the WDRs. Monitoring at specific locations will be completed and phased out as each successive pond is restored and salinity has been reduced to ambient levels.

The monitoring will include continuous recording devices for key parameters and periodic grab samples for specific constituents of concern. Measurement of key continuous monitoring variables (flow, water level stage, salinity, temperature, and TSS/turbidity) will be implemented at several pond and receiving water locations to provide for real-time management of the discharges. Grab samples will be used to characterize long-term changes in other constituents of concern that might be identified by the resource agencies and could include DO, pH, or selected inorganic ions and trace metals. Aquatic toxicity tests will also be conducted on a periodic basis.

The monitoring program could include protocols for updating modeling information as monitoring data are accumulated and will be designed to reduce the frequency of monitoring efforts as the ponds are restored and salinity levels are reduced. Monitoring and potentially modeling will be used to adjust project operations if deemed necessary. At a minimum, monitoring objectives will be consistent with any specified monitoring required by resource agencies and will provide specific procedures for corrective action if the water quality monitoring indicates exceedance of permit conditions.

4.2.3.3 Impact WQ-4: Increase in Conventional Constituents

The flushing of other conventional physical and chemical constituents from the salt ponds could temporarily degrade water quality in the lower Napa River and sloughs. Potential issues of concern include adverse changes in the concentrations of pH, temperature, TSS, DO, BOD, and biostimulatory nutrients (nitrogen and phosphorus). Resources that might be adversely affected include fish habitat and habitat for other marine and estuarine aquatic organisms. Some of the contaminants present in the ponds are potentially harmful to aquatic wildlife if the concentration and duration of exposure is sufficiently elevated above background conditions. Parameters such as DO may be sufficiently suppressed to cause short-term impairment of habitat.

Specific modeling of fate and transport characteristics of these constituents during salinity reduction operations has not been conducted. In general, the concentration differences of conventional constituents between the ponds and background receiving water are relatively low compared to the difference in salinity between the ponds and background receiving water. Therefore, careful management of the salinity reduction operations should result in relatively smaller increases in receiving water concentrations of conventional constituents. However, if salinity reduction operations are not controlled, adverse water quality impacts could potentially occur in receiving waters. Therefore, this impact is considered significant.

Implementation of Mitigation Measure WQ-2, "Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring," would reduce this impact to a less-than-significant level. This measure is described under Impact WQ-3.

4.2.3.4 Impact WQ-5: Discharges of Priority Heavy Metal and Organic Constituents in the Napa River and Local Sloughs

The discharge of inorganic salts and associated salinity changes in the Napa River, in combination with the elevated levels of trace metals (copper and zinc), could result in discharges to the Napa River that exhibit chronic or acute toxicity to aquatic organisms as measured by EPA standardized testing procedures. As described for the conventional constituents, the relative concentration differences in constituents between the ponds and background receiving water are relatively low compared to the same difference in salinity. Therefore, management of salinity should result in relatively greater dilution of the heavy metal and organic constituents to levels that would not adversely impact aquatic organisms. However, if salinity reduction operations are not controlled, adverse water quality impacts could potentially occur in receiving waters. Therefore, this impact is considered significant.

Implementation of Mitigation Measure WQ-2, "Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring," would reduce this impact to a less-than-significant level. This measure is described under Impact WQ-3.

4.2.3.5 Impact WQ-6: Increase in Contribution of Conventional Heavy Metal and Organic Constituents from Recycled Water

Recycled water would be used as dilution water for the mixing chamber and eventually be discharged to the Napa slough. Recycled water typically contains minerals, ammonia, nutrients, residual chlorine, and BOD. It is often less turbid with less temperature variation than natural surface receiving waters. As described below, if recycled water were used for dilution of high salinity waters in Ponds 7, 7A, and 8, the existing discharge locations for recycled water from the NSD and SVCSD WWTPs would be put to the beneficial use of salinity reduction.

Chemical constituents in the recycled water could cause localized water quality changes in the receiving waters by imposing additional oxygen demand, stimulating algae growth, altering temperature, or otherwise modifying background water quality conditions. In particular, nutrients in recycled water have the potential to cause biostimulatory responses to biota in receiving water, such as growth of algae or vascular aquatic vegetation. Depending on the relative concentrations of the constituents in the recycled water and high-salinity ponds at the time of mixing, the concentrations discharged to the receiving water will vary.

The San Francisco Bay RWQCB prohibits surface water discharges of treated wastewater in the north bay region if initial dilution capacity of the receiving water is less than 10:1. Therefore, recycled water that is generated at the NSD and SVCSD WWTPs must currently be stored during the summer and discharged to surface receiving waters during the winter. However, RWQCB Resolution 94-086 would be applied because the recycled water would expedite habitat restoration in the upper ponds. It is likely discharge of recycled water used for diluting the high-salinity water contained in the upper ponds would be allowed during the summer. During the winter, the effects of project-related discharges of recycled water to the mixing chamber, ponds, and receiving waters would not be appreciably different than existing conditions because the discharges would occur as currently permitted by the San Francisco Bay RWQCB.

Discharges of recycled water could impair water quality in the Napa Slough and therefore this impact is considered significant. Implementation of Mitigation Measure WQ-3 would reduce this impact to a less-than-significant level.

Mitigation Measure WQ-3: Design, Operate, and Monitor Use of Recycled Water in Accordance with RWQCB Requirements

The project sponsors and SCWA will design the project to comply with RWQCB permitting requirements. The recycled water monitoring program will include specific monitoring and data quality objectives to ensure that discharge of recycled water does not cause adverse water quality conditions such as eutrophication of receiving waters. Operation of the project may include seasonal limitations and specific restrictions on the quality and quantity of the recycled water discharges. Following successful salinity reduction and restoration of the ponds, any ongoing monitoring of recycled water discharges would be conducted by SVCSD, NSD, and CAC.

4.2.3.6 Impact WQ-7: Water Quality Changes in the Salt Ponds

Reduction of the ponds' existing high salinity is considered a long-term beneficial impact because the restoration would provide additional aquatic habitat. The highly saline upper ponds have limited aquatic diversity because only extremely tolerant organisms can survive in those conditions. Several of the lower ponds (particularly Ponds 4 and 5) have also recently provided limited habitat because of increasing salinities. Dilution of other adverse conditions (i.e., low pH, elevated concentrations of specific constituents) is also considered beneficial. Improved water quality within the ponds would increase aquatic habitat diversity and provide feeding and resting habitat for migratory shorebirds and waterfowl.

Over the long term, the opening of some of the ponds to natural tidal exchange with the Napa River could result in deposition of undesirable chemical constituents in the ponds. The Napa River and lower estuary contain trace metal and organic constituents, and exposure to aquatic organisms from these constituents could increase. However, in general the soluble concentrations of trace metal and organic compounds are higher in the ponds than in the Napa River or San Pablo Bay. Therefore, opening the ponds to tidal action will gradually reduce the elevated pond concentrations down to ambient background conditions. In a similar fashion, the existing pond sediment concentrations are similar or slightly lower than Napa River or San Pablo conditions. Consequently, pond sediment concentrations would be expected not to change or to increase slightly.

Mercury accumulation in the restored wetlands poses a concern because potential formation of methyl mercury is more likely in the chemically reducing conditions of shallow wetland sediments. The potential long-term impacts of bioaccumulation of mercury are not known but are likely to increase over existing levels; therefore, this impact is considered significant. Implementation of Mitigation Measure WQ-4 would reduce this impact to a less-than-significant level.

Mitigation Measure WQ-4: Monitor Pond Water Quality and Use Adaptive Management

The project sponsors will collect water quality and sediment samples periodically and for a sufficient duration to document that accumulation of trace metal and organic compounds does not occur in the restored wetlands. If sampling indicates adverse conditions may be occurring, the result of this data collection effort will be further reviewed by a scientific panel composed of USFWS, NMFS, DFG, the San Francisco Bay RWQCB, San Francisco Estuary Institute, and other groups. The panel will help identify the sources of the constituents and recommend corrective actions to the project sponsors. The project sponsors may implement corrective actions, which may include limiting future restoration efforts or implementing alternative management methods for restoration areas that reduce susceptibility to chronic bioaccumulation.

4.2.4 Salinity Reduction Option 1B: Napa River and Napa Slough Discharge and Breach of Pond 3

Impacts under Salinity Reduction Option 1B are nearly the same as those under Salinity Reduction Option 1A for Impacts WQ-4, WQ-5, WQ-6, and WQ-7 because project-related construction and operation activities would be nearly identical. The primary difference for Option 1B would result from breaching Pond 3 levees to coincide with a period of high Napa River outflow. The breach would be designed to reduce the overall duration of the salinity reduction process in Ponds 3 through 6. Impacts WQ-2 and WQ-3 are slightly different under this option and are described below.

4.2.4.1 Impact WQ-2: Short-Term Construction-Related Water Quality Impacts

Construction activities would generally result in temporary water quality impacts similar to those under Salinity Reduction Option 1A. However, the magnitude of the impacts could be greater because levees at Pond 3 would be breached during a high streamflow. The breach may be initiated with heavy earthmoving equipment and/or explosives and be allowed to naturally erode. The use of explosives would introduce suspended sediment into the Napa River at elevated concentrations compared to the background sediment transport in the streamflow. In addition, the quantity of large sediment particles that would not be carried downstream as suspended sediment and thereby deposit near the discharge location may be sufficient to cover aquatic organism habitats. It is difficult to predict the extent of downstream sedimentation in the Napa River because modeling of sediment discharges has not been conducted and sediment mass transport would depend on the magnitude of Napa River flows and the tidal prism. It would be expected that suspended sediment transport and channel sedimentation patterns would return to normal in a relatively short time period as natural flows would tend to transport the material downstream. With the exception of large rocks, flow in the Napa River would eventually reduce and eliminate above grade deposits of large sediment particles near the breach as erosive forces continue to dislodge and transport the material downstream. Mechanical removal of the levees would result in much less impact from instream sediment discharges because it would be either placed within the confines of the ponds or removed.

Regulatory water quality objectives for turbidity and sediment could be exceeded as a result of the mechanical removal of levees; therefore, this impact is considered significant. Implementation of Mitigation Measure WQ-1, "Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices," and Mitigation Measure WQ-5, "Prepare Levees and Time Breaches," would reduce this impact to a less-than-significant level.

Mitigation Measure WQ-5: Prepare Levees and Time Breaches

The project sponsors will minimize the amount of sediment discharged into the water to the extent possible by preparing the levees for breaching by removing excess material from the levees before the winter season. They will evaluate storm event activity and tidal cycles and initiate the breaching at the time of optimal available quantities of Napa River flow to sufficiently dilute the discharge (i.e., during the peak streamflow and high tide periods). Levees will be breached during the flood tidal cycle to maximize the amount of sediment transported inward to the ponds.

4.2.4.2 Impact WQ-3: Increase in Salinity in the Napa River

This option would accelerate the rate of salinity reduction in Pond 3 as the Napa River levee in Pond 3 would be breached during a high streamflow event. This option would use the large dilution capacity present within the Napa River when high winter flows occur. Salinity reduction in the upper ponds would occur as described for Salinity Reduction Option 1A; the potential water quality impacts would be identical. Numeric water quality modeling of this specific scenario indicated that salinity downstream of the breach would temporarily rise by approximately 7 ppt and be reduced quickly (i.e., within about 2 days) to within 5 ppt of background conditions existing before the breach (Philip Williams and Associates 2002b). The modeling results indicated that elevated salinity conditions would probably be present for less than 1 month until salinity in the pond was completely diluted by tidal exchange.

The Basin Plan water quality objective for salinity is narrative and specifies that salinity from controllable discharges be limited to ensure that beneficial uses are not impaired. The salinity increase would be large and sudden; therefore, this impact is considered significant. Implementation of Mitigation Measure WQ-2, "Design Project in Compliance with Resource Agency Permit Conditions and

Conduct Water Quality Monitoring," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

4.2.5 Salinity Reduction Option 1C: Napa River and Napa Slough Discharge with Breaches of Ponds 3 and 4/5

Impacts under Salinity Reduction Option 1C are nearly the same as those under Salinity Reduction Option 1A for Impacts WQ-4, WQ-5, WQ-6, and WQ-7 because project-related construction and operation activities would be nearly identical. The primary difference for Option 1C would result from creation of additional levee breaches at Ponds 3 and 4/5 to coincide with a period of high Napa River outflow. The breaches would be designed to reduce the overall duration of salinity reduction in Ponds 3 through 6. Impacts WQ-2 and WQ-3 are slightly different under this option and described below.

4.2.5.1 Impact WQ-2: Short-Term Construction-Related Water Quality Impacts

The short-term construction-related water quality impacts of Salinity Reduction Option 1C would be slightly larger than those of Salinity Reduction Option 1B because a greater amount of ground disturbance would occur, particularly in association with the planned levee breaches. Using explosives to destroy the levees would cause large amounts of suspended sediment and turbidity to be introduced into the stream, potentially causing temporary sedimentation of aquatic habitat. This impact is considered significant. Implementation of Mitigation Measures WQ-1, "Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices," and WQ-5, "Prepare Levees and Time Breaches," would reduce this impact to a less-than-significant level. These measures are described under Salinity Reduction Options 1A and 1B, respectively.

4.2.5.2 Impact WQ-3: Increase in Salinity in the Napa River

This option would greatly accelerate the rate of salinity reduction in Ponds 3 and 4/5 as the Napa River levee in Ponds 3 and 4/5 would be breached during a high streamflow event. Salinity reduction in the upper ponds would occur as described for Salinity Reduction Option 1A; the potential water quality impacts would be identical. Figure 4-9 shows simulated change in average daily salinity in the Napa River for preproject conditions and during the first 6 months following levee breaching. The data indicate that salinity at the breach would increase by up to 18 ppt during the first 24 hours. The maximum salinity increase would drop to approximately 12 ppt the second day and to a differential of less than 5 ppt within 2 weeks. The change in salinity is within the range of normal variation in the river; however, the rate of change would be greater than under normal conditions. It should be noted that the modeling assumed that Ponds 3 and 4 would be breached at the same time; this would overstate the expected salinity increase associated with the proposed phased breaches. The salinity increase would be large and sudden; therefore, this impact is considered significant. Implementation of Mitigation Measure WQ-2, "Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring," would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

4.2.6 Salinity Reduction Option 2: Napa River and San Pablo Bay Discharge

Impacts under Salinity Reduction Option 2 are nearly the same as those under Salinity Reduction Option 1A for Impacts WQ-2, WQ-5, and WQ-7. Impacts WQ-3, WQ-4, and WQ-6 are slightly different and are described below.

4.2.6.1 Impact WQ-3: Increase in Salinity in the Napa River, Salt Ponds 1/1A and 2, and San Pablo Bay

Salinity reduction under Salinity Reduction Option 2 would result in discharges of highly saline water to the Napa River and San Pablo Bay. Figure 4-10 shows the simulated change in average daily salinity in the Napa River for preproject conditions. Modeled data, when compared to existing conditions, indicate that salinity in the Napa River would increase by about 1 ppt. The potential salinity increase in San Pablo Bay is also expected to be small because ambient salinity conditions in the bay are higher than in the Napa River and the extended route of travel time through the ponds would provide a large dilution capacity for existing salts. However, water quality could be substantially degraded in Ponds 1, 1A, and 2 compared to existing conditions by diluting and mixing bittern in these ponds. Bittern dilution would occur at approximately 1:40 or 2 to 2.5 times the allowable open water discharge concentration (PWA 2002b). Discharges to San Pablo Bay would have higher salinity than under existing conditions and could also have elevated levels of bittern. Therefore, this impact is considered significant. Implementation of Mitigation Measure WQ-2, "Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring," would reduce the impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

4.2.6.2 Impact WQ-4: Increase in Conventional, Trace Metal, and Organic Constituents

This impact would be nearly the same as that under Salinity Reduction Option 1A except that San Pablo Bay (instead of Napa Slough) would receive discharged water. As described under Salinity Reduction Option 1A, the concentration differences of conventional and priority trace metal and organic constituents between the ponds and background receiving water are relatively low compared to the difference in salinity. Therefore, careful management of the salinity reduction operations should result in relatively smaller increases in receiving water concentrations of conventional constituents. However, if salinity reduction operations are not controlled, adverse water quality impacts could potentially occur in receiving waters. This impact is considered significant. Implementation of Mitigation Measure WQ-2, “Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring,” would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

4.2.6.3 Impact WQ-6: Increase in Contribution of Conventional, Trace Metal, and Organic Constituents from Recycled Water

This impact is nearly the same as that under Salinity Reduction Option 1A except that some of the lower ponds (Ponds 1, 1A, 2, 6, and 6A) and San Pablo Bay would receive recycled water. Nutrients (nitrogen and phosphorus) could stimulate algae and vascular aquatic vegetation growth in the lower ponds because the ponds would be relatively shallow, receive adequate light, and have warm water temperatures. It is anticipated that chemical constituents would be diluted substantially because of the large volume of water and dilution capacity in the ponds. Use of recycled water to restore the natural salinity patterns in the salt ponds is particularly applicable under the RWQCB Resolution 94-086 to restore and enhance wetlands when initial dilution capacity of the recycled water is limited. However, this impact is still considered significant. Implementation of Mitigation Measure WQ-3, “Design, Operate, and Monitor Use of Recycled Water in Accordance with RWQCB Requirements,” would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

4.2.7 Water Delivery Option

4.2.7.1 Impact WQ-2: Short-Term Construction-Related Water Quality Impacts

Water Delivery Project Component

Construction of the Sonoma Pipeline could cause water quality impacts primarily because sediment from disturbed soils could erode into local waterways and other pollutants from construction activities could enter local watercourses. Construction of the pipeline would disturb soil in the construction easement surrounding the pipe (approximately 30 feet wide) and the staging areas where contractors store supplies. Approximately 16 acres of soil would be disturbed along the entirety of the pipeline construction route. Pipeline construction would proceed along the route in an incremental manner with the active construction area being 30 feet wide and 200–300 feet long. As such, the area with the greatest potential for erosion and sedimentation impacts at any given time during pipeline construction would be approximately 0.14–0.20 acre, or double that amount if work were proceeding simultaneously at two sites.

The disturbed soils would be reseeded or repaved as part of the construction project, so there would be no long-term impacts. However, during the construction process, precipitation could produce stormwater runoff that contains elevated levels of sediment, which would exacerbate sedimentation concerns in area rivers and creeks. Additional sediments or pollutants could be eroded into local waterways as a result of water used during the construction process.

Construction practices have the potential to pollute waterways. The following activities that could occur on the construction sites for the Water Delivery Project Component have the potential to allow pollutants to enter watercourses: dewatering; paving; material delivery, storage, and material use; contaminated soils/water removal; concrete or asphalt waste removal; vehicle/equipment cleaning; vehicle/equipment fueling; and vehicle/equipment maintenance.

Construction of the Sonoma Pipeline could require construction dewatering during excavation for, and placement of, the pipelines. Similarly, excavation and use of pipeline jacking and receiving pits at the crossing of Huichica Creek or the unnamed creek could require temporary dewatering. The groundwater in the pipeline vicinity is generally of good quality, although it has some localized areas of increased salinity or boron concentrations. The water would be discharged into nearby drainage areas, which could potentially transfer boron or salinity into area waterways.

The construction of the Napa Pipeline would occur in a manner similar to that described above for the Sonoma Pipeline. Given that the Napa Pipeline is shorter than the Sonoma Pipeline, implementation of the Napa Pipeline project would disturb less acreage, approximately 11 acres, and would result in fewer potential water quality impacts similar than those described for the Sonoma Pipeline.

Construction of the CAC Pipeline would occur in a manner similar to that described above for the Sonoma Pipeline. Given that the CAC Pipeline is shorter than the Sonoma Pipeline, implementation of the CAC Pipeline project would disturb less acreage, approximately 7 acres. The CAC Pipeline therefore would result in fewer potential water quality impacts than those described for the Sonoma Pipeline.

This impact is considered significant. Implementation of Mitigation Measure WQ-6 would reduce this impact to a less-than-significant level.

Mitigation Measure WQ-6: Prepare and Implement Storm Water Pollution Prevention Plans

The contractor will complete and implement a SWPPP to describe construction site characteristics and identify the BMPs that should be applied to each site. The SWRCB has established a list of construction BMPs that help owners and contractors understand the BMPs that could be helpful on each site.

For the currently proposed pipelines, implementing BMPs from the following groups would mitigate potential impacts:

- soil stabilization measures, such as preserving existing vegetation and use of mulch or temporary plantings, to minimize soil disturbance;
- sediment control measures to prevent disturbed soils from entering waterways, including silt fences around disturbed areas and straw bales around drainage areas;
- tracking control measures to reduce the amount of sediment leaving the construction site on vehicle or equipment tires; and
- nonstormwater measures, such as monitoring water quality of dewatering operations and material delivery and storage requirements to reduce spills, to decrease other sources of pollutants.

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

Water Delivery Program Component

While the exact alignments and construction methods have not yet been determined for the Program Component of the Water Delivery Option, the overall construction-related impacts of the Program Component (i.e., potential future pipelines from the City of Petaluma, Novato SD, and LGVSD WWTPs) would be comparable to those described above for the Water Delivery Project Component based on similarities in the basic nature and design of the pipelines. This impact is considered significant. Implementation of Mitigation Measure

WQ-6, “Prepare and Implement Storm Water Pollution Prevention Plans," would reduce this impact to a less-than-significant level. This measure is described under “Water Delivery Project Component” above.

4.2.7.2 Beneficial Impact WQ-8: Long-Term Changes to Water Quality in Local Rivers and Salt Ponds from Project Operations

Water Delivery Project Component

SVCSD currently discharges treated wastewater into area waterways during the wet season. SVCSD would change its discharge location from Schell Slough to the Napa River Salt Marsh Restoration Project site. The reclaimed water would then be mixed with water from Ponds 7, 7A, and 8, and the newly mixed water would then be discharged to the Napa River. Potential effects of this new discharge pattern are also discussed under Impact WQ-6 above. After the pond restoration is complete, the reclaimed water would be used for agricultural irrigation during the summer. This next step would reduce or eliminate discharge into the San Pablo Bay system. The recycled water currently contains low levels of copper and mercury, which are both listed as San Pablo Bay contaminants on the 303(d) list. Reducing discharge that contains these metals would help the north bay region achieve the levels set as part of the TMDL process. In addition, projects that use wastewater effluent for the restoration and enhancement of wetlands may be considered for implementation under RWQCB Resolution 94-086 provided that a net environmental benefit can be justified. This impact is considered less than significant, and, in some respects, may be beneficial; therefore, no mitigation is required.

NSD and CAC WWTPs discharge treated wastewater into the Napa River during the wet season and CAC WWTP discharges to North Slough, and portions of these discharges would also be relocated to the Napa River Unit for the duration of the restoration effort. After the restoration, the reclaimed water would be also used for agricultural irrigation. This impact is considered less than significant, and, in some respects, may be beneficial; therefore, no mitigation is required.

Water Delivery Program Component

Similar to the Water Delivery Project Component, under the Water Delivery Program Component, sanitary districts’ discharge points would be moved from local waterways within the San Pablo Bay watershed to the Napa River Unit. The City of Petaluma discharges into the Petaluma River, Novato SD discharges into San Pablo Bay, and LGVSD discharges into Gallinas Creek. Reducing treated wastewater discharges into these rivers and creeks would have impacts similar to those described above for the Water Delivery Project Component. This impact is considered less than significant. No mitigation is required.

4.2.8 Habitat Restoration Option 1: Mixture of Tidal Marsh and Managed Ponds

Impacts under Habitat Restoration Option 1 are nearly the same as those under Salinity Reduction Option 1A for Impacts WQ-5 and WQ-6. Impacts WQ-2, WQ-3, WQ-4, and WQ-7 are slightly different and are described below.

4.2.8.1 Impact WQ-2: Short-Term Construction-Related Water Quality Impacts

The types of short term and intermittent construction-related impacts of levee breaches would be similar to those described under Salinity Reduction Option 1A, except that numerous additional breaches would be implemented for Ponds 3, 4, and 5. Extensive construction grading and earthmoving operations would also occur to lower levees and create starter channels in the areas slated for tidal marsh. The construction would occur over a longer time period and facilities would be constructed adaptively only as restoration goals are achieved. Additional construction would be required for extensive levee repairs and maintenance activities that are considered necessary for some of the ponds. For example, construction of facilities for habitat restoration at Ponds 6/6A would not occur for many years (until Ponds 3, 4, and 5 are sufficiently restored). Sediment discharge quantities and discharge rates into receiving waters could be minimized because construction operations would occur over several construction seasons, would occur over large areas in different regions of the pond system, not occur all at the same time, and generally be conducted in areas that are distant from direct exposure to the adjacent river and slough channels. The total mass of sediment entering receiving waters would probably be larger than described for salinity reduction options alone, however, it is expected that a majority of the material would likely settle within the pond system and not result in direct discharges to the adjacent channels.

This impact is considered significant. Implementation of Mitigation Measure WQ-1, “Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices,” would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A. In addition, the levee breaches, levee lowering, levee repair, and starter channel construction activities should be designed to minimize sediment discharge to receiving waters to the extent possible. Implementation of Mitigation Measure WQ-5, “Prepare Levees and Time Breaches,” would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1B.

4.2.8.2 Impact WQ-3: Increase in Salinity in the Napa River

This impact to salinity conditions in the ponds and adjacent channels would depend on the specific elements of salinity reduction procedures that are implemented. Salinity reduction for this alternative would most likely consist of either Salinity Reduction Option 1A, 1B, or 1C. Habitat restoration would be implemented following reduction in salinity and habitat restoration procedures would not specifically change the pattern of salinity impacts to receiving waters as they are described above. Over the long-term, salinity in the managed ponds would still have the potential to develop adverse salinity concentrations as evaporation from the water surface and evapotranspiration through plants occurs. In the absence of careful management of water exchange operations, these ponds could continue to exhibit adverse impacts to the biota that currently inhabit or become established following restoration.

Therefore, this impact is still considered significant. Implementation of Mitigation Measures WQ-2, “Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring,” would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

4.2.8.3 Impact WQ-4: Increase in Conventional, Trace Metal, and Organic Constituents in the Napa River

As described above, Habitat Restoration Option 1 would have water quality impacts for conventional and priority trace metal and organic constituents that depend on the specific salinity reduction option that is implemented. Habitat restoration options would not have specific additional impacts, however, construction related disturbances of sediment contained within the ponds may contribute additionally to discharges to receiving waters as construction occurs for levee lowering, berm and ditch blocks, and starter channels. This impact is considered significant. Implementation of Mitigation Measure WQ-2, “Design Project in Compliance with Resource Agency Permit Conditions and Conduct Water Quality Monitoring,” would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

4.2.8.4 Impact WQ-7: Water Quality Changes in the Salt Ponds

As described under Salinity Reduction Option 1A, managed ponds would be exposed to sedimentation associated with suspended sediments in tidal exchange water. Ponds would also be exposed to a host of conventional inorganic constituents, trace metals, and organic compounds associated with tidal exchange water and recycled water. However, habitat restoration elements are not expected to cause explicit additional impacts in the ponds from chemical constituents. This impact is considered less than significant.

4.2.9 Habitat Restoration Option 2: Tidal Marsh Emphasis

Impacts under Habitat Restoration Option 2 are nearly the same as those under Habitat Restoration Option 1 for Impacts WQ-3, WQ-4, WQ-5, WQ-6, and WQ-7. Impact WQ-2 is slightly different and is described below.

4.2.9.1 Impact WQ-2: Short-Term Construction-Related Water Quality Impacts

This impact is nearly the same as that under Habitat Restoration Option 1. A new levee within Pond 2 under this option would require additional inwater construction compared with Habitat Restoration Option 1. Considerably more construction would occur under this alternative for levee lowering and starter channel construction. This impact is considered significant. Implementation of Mitigation Measure WQ-1, “Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices,” would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A.

4.2.10 Habitat Restoration Option 3: Pond Emphasis

Impacts under Habitat Restoration Option 3 (Impacts WQ-2, WQ-3, WQ-4, WQ-5, WQ-6, and WQ-7) are nearly the same as those described under Habitat Restoration Option 1. Slightly less short-term construction related impacts would occur because the extent of construction for levee removals, ditch blocks, and starter channels would be less.

4.2.11 Habitat Restoration Option 4: Accelerated Restoration

Impacts under Habitat Restoration Option 4 are nearly the same as those under Habitat Restoration Option 1 for Impacts WQ-3, WQ-4, WQ-5, WQ-6, and WQ-7. Impact WQ-2 is slightly different and is described below.

4.2.11.1 Impact WQ-2: Short-Term Construction-Related Water Quality Impacts

Construction activities for Habitat Restoration Option 4 would result in similar temporary water quality impacts similar to those for the other habitat restoration options. However, the increased number/extent of habitat restoration features would result in a longer duration of construction and would require a greater amount of construction, increasing the possibility of construction-related water quality impacts. Therefore, this impact is considered significant. Implementation of Mitigation Measure WQ-1, "Obtain RWQCB Authorization under Waste Discharge Requirements or NPDES Stormwater Permit for General Construction Activity and Implement Best Management Practices," would still protect water quality and would reduce this impact to a less-than-significant level. This measure is described under Salinity Reduction Option 1A. The additional protections described under Habitat Restoration Option 1, for any levees that are breached using explosives, would also be implemented to minimize potential downstream sedimentation impacts.