3.21 Water Quality

This section describes surface water quality conditions that could be affected by implementation of the proposed program. This section is composed of the following subsections:

- Section 3.21.1, "Environmental Setting," describes the physical conditions in the study area as they apply to surface water quality.
- Section 3.21.2, "Regulatory Setting," summarizes federal, State, and regional and local laws and regulations pertinent to evaluation of the proposed program's impacts on surface water quality.
- Section 3.21.3, "Analysis Methodology and Thresholds of Significance," describes the methods used to assess the environmental effects of the proposed program and lists the thresholds used to determine the significance of those effects.
- Section 3.21.4, "Environmental Impacts and Mitigation Measures for NTMAs," discusses the environmental effects of near-term management activities (NTMAs) and identifies mitigation measures for significant environmental effects.
- Section 3.21.5, "Environmental Impacts, Mitigation Measures, and Mitigation Strategies for LTMAs," discusses the environmental effects of long-term management activities (LTMAs), identifies mitigation measures for significant environmental effects, and addresses conditions in which any impacts would be too speculative for evaluation (CEQA Guidelines, Section 15145).

NTMAs and LTMAs are described in detail in Section 2.4, "Proposed Management Activities."

For discussions of groundwater quality and flood management facilities and surface water features, respectively, see Section 3.11, "Groundwater Resources," and Section 3.13, "Hydrology."

3.21.1 Environmental Setting

Information Sources Consulted

Sources of information used to prepare this section include the following:

- *CALFED Bay-Delta Program Final Programmatic Environmental Impact Statement/Environmental Impact Report* (CALFED 2000)

- *The Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board, Central Valley Region: The Sacramento River Basin and the San Joaquin River Basin* (Basin Plan) (Central Valley RWQCB 2009)

- *San Joaquin River Restoration Program Draft Environmental Impact Statement/Environmental Impact Report* (Reclamation 2011)

- *Final 2010 Integrated Report* (SWRCB 2010a)

Geographic Areas Discussed

Surface water quality resources are discussed for the following geographic areas:

- Extended systemwide planning area (Extended SPA) divided into the Sacramento and San Joaquin Valley and foothills, and the Sacramento–San Joaquin Delta (Delta) and Suisun Marsh

- Sacramento and San Joaquin Valley watersheds

- SoCal/coastal Central Valley Project/State Water Project (CVP/SWP) service areas

None of the management activities included in the proposed program would be implemented in the SoCal/coastal CVP/SWP service areas. In addition, implementation of the proposed program would not result in long-term reductions in water deliveries to the SoCal/coastal CVP/SWP service areas (see Section 2.6, “No Near- or Long-Term Reduction in Water or Renewable Electricity Deliveries”). Given these conditions, little to no effect on water quality is expected in the portions of the Sacramento and San Joaquin Valley watersheds outside of the Extended SPA. Therefore, that geographic area is not discussed in detail in this section.

Extended Systemwide Planning Area

This section describes the water quality conditions in the Sacramento and San Joaquin Valley and foothills and in the Delta and Suisun Marsh. Water quality conditions during flood events would generally be affected by potential increases in constituent loading associated with stormwater runoff and increased sediment loading and turbidity as a result of bank and bed erosion. Pollutants commonly found in stormwater runoff include heavy metals, pesticides and fertilizers, oil and grease, bacteria, and sediment. However, none of the water quality segments in the extended systemwide planning area are listed as impaired for sediments on the Clean Water Act Section 303(d) list.

The Sacramento Valley and foothills and the San Joaquin Valley and foothills are discussed separately below because of the unique hydrologic conditions and water supply roles of each of these geographic areas.

Sacramento Valley and Foothills Surface water quality in the Sacramento Valley and foothills is affected by several factors: natural runoff, historical mining activities, agricultural return flows, operation of flow-regulating facilities, wastewater treatment effluent, construction, logging, grazing, urbanization, and recreation. In general, water quality in the Sacramento Valley and foothills is suitable for designated beneficial uses. However, there are concerns about possible water quality effects of metal contamination from abandoned mercury and other hard-rock mining activities. Other sources of pollutants in the Sacramento Valley and foothills include agricultural runoff present after the irrigation season and runoff from dewatered rice fields. Wastewater treatment effluent and stormwater runoff contribute pollutants from urban areas.

Water quality characteristics of the upper Sacramento River (Shasta Lake to Knights Landing) and its tributaries and the lower Sacramento River (downstream from Knights Landing) and its tributaries are discussed separately in the following sections. Hydrologic features of the Sacramento Valley and foothills are shown in Figure 3.21-1.

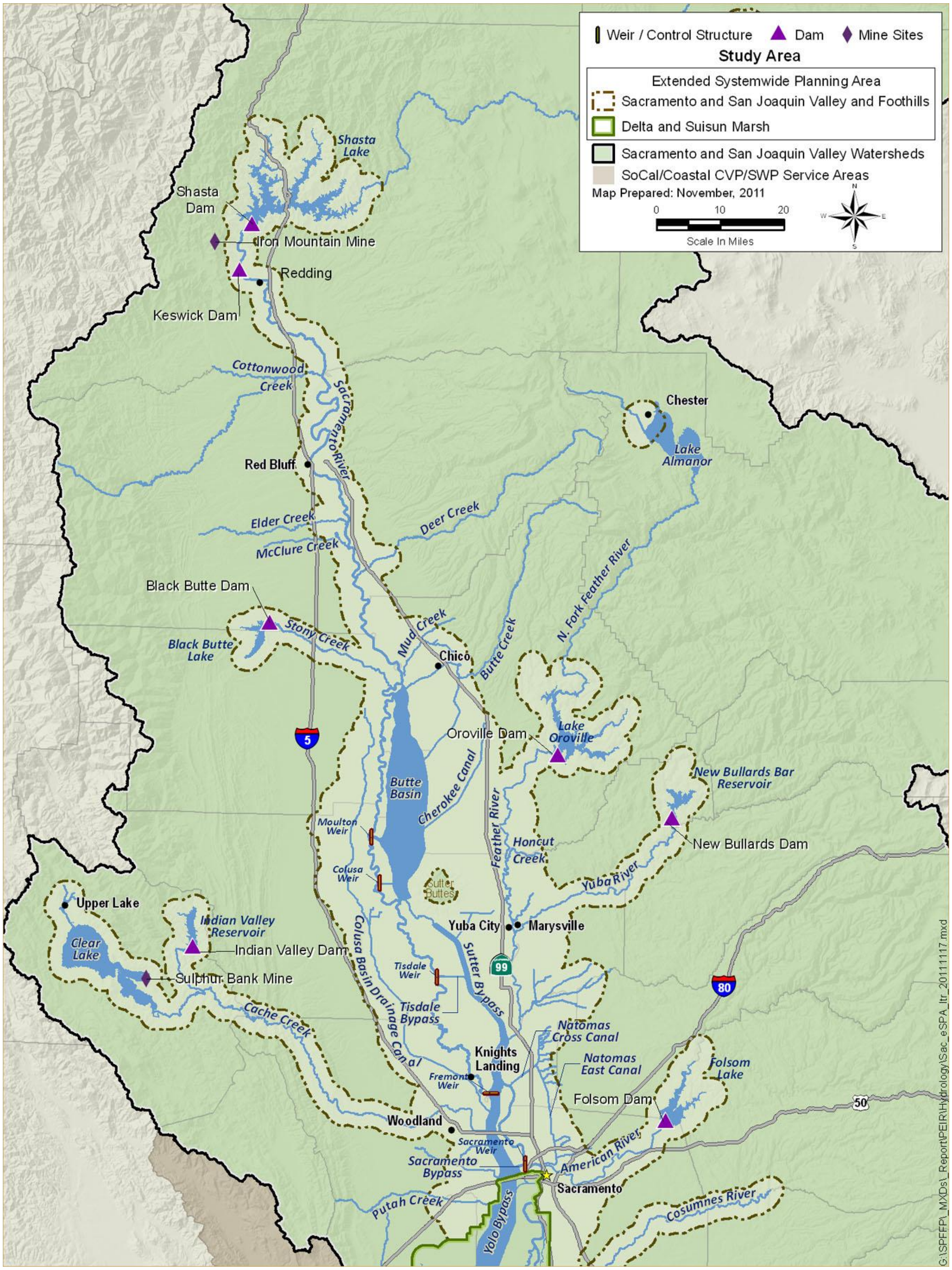

Figure 3.21-1. Hydrologic Features of the Sacramento Valley and Foothills

Upper Sacramento River Water Bodies Water quality in the upper Sacramento River is generally acceptable for most designated beneficial uses. Only when stormwater-driven runoff is present are water quality objectives typically not met. Concentrations of metals and pesticides in particular tend to be highest during high-flow events (Domagalski et al. 2000).

Metals are a key water quality concern in much of the upper Sacramento River and its tributaries. A major source of metals in this geographic area is drainage from inactive mines in the Iron Mountain area of the West Shasta mining district (see Figure 3.21-1). During mining and smelting activities that occurred from the 1880s to the 1960s, Iron Mountain's acid mine drainage discharged directly to Spring Creek, a Sacramento River tributary upstream from Redding (Alpers et al. 2000). Springtime methylmercury concentrations have been observed to be higher during flood events (Domagalski et al. 2000). Water quality enhancement actions at mines in the upper Sacramento River area and improved coordination of Spring Creek and Keswick reservoirs have resulted in a notable decrease in the number of water quality targets exceeded in the past 10 years.

Elevated mercury concentrations in the upper Sacramento River correlate with high concentrations of suspended sediment and high flows because much of the mercury transported is adsorbed to suspended sediments (Domagalski et al. 2000). Rates of loading and discharges of suspended sediment in the upper Sacramento River watershed have been altered by activities such as mining, agriculture, urbanization, and dam construction. Storing and diverting reservoir water to produce hydroelectric power or for other purposes can affect sediment yield, downstream sediment levels, and transport characteristics.

Historical hydraulic gold mining has had a considerable effect on sediment yield in the Sacramento River watershed (Wright and Schoellhamer 2004). During the late 1800s, such mining introduced mass quantities of silt, sand, and gravel into the Sacramento River system. Suspended sediment was washed downstream into the Delta. Peak-flow events are primary drivers of sediment mobilization, bed scour, and bank erosion in the Sacramento River. However, the rates at which sediment is supplied upstream and the distribution of sediment loads also affect loadings of suspended sediment (CALFED 2003). The upper Sacramento River contributes little coarse sediment from erosion because these sediments are bound by erosion-resistant bedrock and terrace deposits (The Nature Conservancy 2006). Substantial quantities of sediment are detained behind dams on the Sacramento River and its tributaries. As a result, the amount of suspended sediment and correlated mercury levels in the Sacramento River is tending to decrease (Wright and Schoellhamer 2004).

As discussed in Section 3.5.2, "Regulatory Setting," in Section 3.5, "Biological Resources—Aquatic," Section 303 of the federal CWA requires states to adopt water quality standards for all surface waters of the United States. Section 303(d) of the CWA requires states and authorized Native American tribes to develop a list of water quality–impaired segments of waterways. CWA Section 303(d) listings for the upper Sacramento River and its tributaries and reservoirs within the Sacramento Valley and foothills, as determined by the Central Valley Regional Water Quality Control Board (Central Valley RWQCB), are shown in Table 3.21-1.

Table 3.21-1. Clean Water Act Section 303(d) List of Water Quality–Limited Water Bodies—Upper Sacramento River and Its Tributaries

Water Body	Beneficial Use Designations	Pollutant/ Stressor	Potential Source	Affected Area/ Reach Length
Shasta Lake	MUN, AGR, POW, REC-1, REC-2, WARM, COLD, SPWN, WILD	Mercury	Resource extraction	27,335 acres
Sacramento River, Keswick Dam to Cottonwood Creek	MUN, AGR, IND, POW, REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD, NAV	Unknown toxicity	Source unknown	15 miles
Stony Creek	AGR, REC-1, REC-2, WARM, COLD (P), MIGR, SPWN, WILD	Chlorpyrifos	Source unknown	42 miles
		Diuron	Source unknown	
		pH	Source unknown	
		Sediment toxicity	Source unknown	
		Unknown toxicity	Source unknown	
Black Butte Lake	AGR, REC-1, REC-2, WARM, SPWN, WILD	Mercury	Resource extraction	4,507 acres
Sacramento River, Cottonwood Creek to Red Bluff	MUN, AGR, IND, POW, REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD, NAV	Mercury	Resource extraction	16 miles
		Unknown toxicity	Source unknown	
Sacramento River, Red Bluff to Knights Landing	MUN, AGR, IND, POW, REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD, NAV	DDT	Agriculture	15 miles
		Dieldrin	Agriculture	
		Mercury	Resource extraction	
		PCBs	Source unknown	
		Unknown toxicity	Source unknown	

Table 3.21-1. Clean Water Act Section 303(d) List of Water Quality–Limited Water Bodies—Upper Sacramento River and its Tributaries (contd.)

Water Body	Beneficial Use Designations	Pollutant/ Stressor	Potential Source	Affected Area/ Reach Length
Sutter Bypass	AGR, REC-1, WARM, MIGR, SPWN, WILD	Mercury	Resource extraction	19 miles

Sources: SWRCB 2010a; Central Valley RWQCB 2009

Key:
(P) = Potential beneficial use
AGR = agricultural supply
COLD = cold freshwater habitat
DDT = dichloro-diphenyl-trichloroethane
IND = industrial service supply
MIGR = migration of aquatic organisms
MUN = municipal and domestic supply
NAV = navigation
PCB = polychlorinated biphenyl
POW = hydropower generation
REC-1 = water contact recreation
REC-2 = noncontact water recreation
SPWN = spawning, reproduction, and/or early development
WARM = warm freshwater habitat
WILD = wildlife habitat

The water quality control plans, or basin plans, applicable to the proposed program are summarized in the discussion of State water quality regulations below in Section 3.21.2, “Regulatory Setting.” As discussed in greater detail in Section 3.5.2, “Regulatory Setting,” in Section 3.5, “Biological Resources—Aquatic,” the State is required to develop a total maximum daily load (TMDL) for each of the Section 303(d) listed pollutants and water bodies. The TMDL is the amount of loading that the water body can receive and still meet water quality standards. Once TMDLs and basin plan amendments have been completed for a particular constituent, the constituent is delisted. The Central Valley RWQCB implemented TMDLs and amendments to the Basin Plan for cadmium, copper, and zinc in 2002. Cadmium, copper, and zinc were later removed from the CWA Section 303(d) list for the Sacramento River from Shasta Dam to Knights Landing. Therefore, these and other water quality constituents (diazinon and chlorpyrifos) in the upper Sacramento River and its tributaries for which Basin Plan amendments and/or TMDLs have been completed are not shown in Table 3.21-1. TMDL and Basin Plan amendments are in place for two organophosphorus pesticides, diazinon and chlorpyrifos, for the entire Sacramento River below Shasta Dam. However, the TMDL and Basin Plan amendment for chlorpyrifos do not cover Stony Creek.

Water quality conditions in the upper Sacramento River region are detailed below for the following areas listed in Table 3.21-1: Shasta Lake; the Sacramento River, Keswick Dam to Cottonwood Creek; Stony Creek; Black Butte Lake; the Sacramento River, Cottonwood Creek to Red Bluff; the Sacramento River, Red Bluff to Knights Landing; and the Sutter Bypass. Water quality conditions along the Sacramento River between Shasta Dam and Keswick Dam, though not listed in Table 3.21-1, are also summarized below. This reach does not appear in Table 3.21-1 because it is not on the CWA Section 303(d) list.

Shasta Lake Water quality in Shasta Lake and its vicinity generally meets the standards for designated beneficial uses identified in the Basin Plan. Several pollution sources affect surface water quality in Shasta Lake and its vicinity: high turbidity from controllable sources of sediment discharges (e.g., land development and roads); high concentrations of nitrates and dissolved solids from range and agricultural runoff or septic tank failures; contaminated street and lawn runoff from urban areas, roads, and railroads; mercury from historical mining activities; and discharges of warm water into cold-water streams. In some areas, surface water quality does not meet existing standards because of past management activities.

Sacramento River, Shasta Dam to Keswick Dam Between Shasta Dam and Keswick Dam, a major source of flow in the upper Sacramento River is high-quality snowmelt that collects in upstream reservoirs and is released in response to water needs or flood management. As a result, water quality below Shasta Dam is generally acceptable for most designated beneficial uses. However, the quality of surface water is also influenced by agricultural, historical mining, and municipal and industrial activities along the Sacramento River downstream from Shasta Dam. This reach is not on the CWA Section 303(d) list and therefore does not appear in Table 3.21-1. Water temperature in the Sacramento River from Shasta Dam to Keswick Dam is managed primarily through releases from Shasta Dam. Shasta Dam's temperature control device allows selective withdrawal of water from different reservoir depths (and therefore with different temperatures) and enables achievement of downstream temperature goals in the Sacramento River (Reclamation 2004).

Sacramento River, Keswick Dam to Cottonwood Creek Between Keswick Dam and Cottonwood Creek, water quality is limited by unknown toxicity. Impairments for unknown toxicity on the 2010 CWA Section 303(d) list refer to water column toxicity from a cause that was unknown at the time the list was prepared. In this reach, water temperature is a principal water quality issue. Multiple water quality objectives related to water temperature have been designated for the upper Sacramento River. The Basin Plan specifies that water temperature shall not be elevated above 56 degrees Fahrenheit (°F) from Keswick Dam to Hamilton City (Central Valley RWQCB 2009). In addition, at no time or place shall the temperature of cold or warm intrastate waters be increased more than 5°F above the natural temperature of receiving waters (Central Valley RWQCB 2009).

Releases from Keswick Dam are managed to meet water temperature requirements. Shasta Dam release flows are mixed with flows from Whiskeytown Reservoir in Keswick Reservoir, then released into the upper Sacramento River. Optimal water temperature for rivers in the Sacramento River basin is maintained through much of the year, but managing water temperatures can be difficult during low-flow periods (USGS 2000). Historically, low-flow events and lack of flexibility in dam operations have caused water temperatures to periodically approach critical levels for sustaining juvenile salmon populations. In addition to low flows, high water temperatures from reservoir releases, coupled with natural instream warming, can cause elevated river water temperatures (Vermeyen 1997).

Stony Creek Water quality criteria are not currently met in Stony Creek. Water quality concerns for Stony Creek include several pesticides, pH, sediment toxicity, and unknown toxicity.

Black Butte Lake Black Butte Lake is operated to manage flood flows on the Sacramento River, and to provide irrigation, water supply, and recreational opportunities. Black Butte Lake's water quality is limited by mercury.

Sacramento River, Cottonwood Creek to Red Bluff Sacramento River water quality between Cottonwood Creek and Red Bluff is limited by mercury and unknown toxicity. As described above, TMDLs and Basin Plan amendments for cadmium, copper, and zinc were implemented in 2002, and all three constituents were removed from the CWA Section 303(d) list. However, metal loading remains high enough to cause periodic exceedence (Central Valley RWQCB 2002). Water temperature issues in this reach are similar to those in the reach from Keswick Dam to Cottonwood Creek, described above.

Sacramento River, Red Bluff to Knights Landing Between Red Bluff and Knights Landing, water quality is limited by pesticides from agricultural runoff—specifically, dieldrin and dichloro-diphenyl-trichloroethylene (DDT)—in addition to mercury (discussed above), polychlorinated biphenyls (PCBs), and unknown toxicity.

Sutter Bypass Water quality in the Sutter Bypass is similar to that in the upper Sacramento River. Historically, widespread use of the organophosphate pesticides diazinon and chlorpyrifos resulted in aquatic toxicity in the Sutter Bypass. In 2001, the Sacramento River Watershed Program developed and implemented a water quality management strategy that caused diazinon concentrations to decrease, prompting removal of the Sutter Bypass from the CWA Section 303(d) list in 2006 (EPA 2010). As with much of the upper Sacramento River, mercury is a key constituent of concern within the Sutter Bypass.

Lower Sacramento River Water Bodies Water quality in the lower Sacramento River is affected by agricultural runoff, acid mine drainage, stormwater discharges, municipal and industrial wastewater discharges, water releases from dams, diversions, and urban runoff. However, the river's flow volumes generally provide sufficient dilution to prevent concentrations of contaminants in the river from reaching elevated levels. TMDLs and Basin Plan amendments for diazinon and chlorpyrifos are in place for the entire lower Sacramento River. CWA Section 303(d) listings for the lower Sacramento River and its tributaries within the Sacramento Valley and foothills are shown in Table 3.21-2.

Table 3.21-2. Clean Water Act Section 303(d) List of Water Quality–Limited Water Bodies—Lower Sacramento River and Its Tributaries

Water Body	Beneficial Use Designations	Pollutant/ Stressor	Potential Sources	Affected Area/ Reach Length
Sacramento River, Knights Landing to the Delta	MUN, AGR, REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD, NAV	Chlordane	Agriculture	16 miles
		DDT	Agriculture	
		Dieldrin	Agriculture	
		Mercury	Resource extraction	
		PCBs	Source unknown	
		Unknown toxicity	Source unknown	
Lake Oroville	MUN, AGR, POW, REC-1, REC-2, WARM, COLD, SPWN, WILD	Mercury	Resource extraction	15,400 acres
		PCBs	Source unknown	
Feather River, Lake Oroville to the Sacramento River	MUN, AGR, REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD	Chlorpyrifos	Agriculture	42 miles
		Group A pesticides[1]	Agriculture	
		Mercury	Resource extraction	
		PCBs	Source unknown	
		Unknown toxicity	Source unknown	
New Bullards Bar Reservoir	MUN, AGR, PROC, POW, REC-1, REC-2, WARM, COLD, SPWN, WILD	Mercury	Resource extraction	3,864 acres
Yuba River, New Bullards Bar Reservoir to the Feather River	MUN, AGR, POW, REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD	Mercury	Resource extraction	10 miles
Bear River, Camp Far West Reservoir to the Feather River	MUN, AGR, POW, REC-1, REC-2, WARM, COLD, MIGR (P), SPWN (P), WILD	Chlorpyrifos	Agriculture	21 miles
		Copper	Source unknown	
		Diazinon	Agriculture	
		Mercury	Resource extraction	

Table 3.21-2. Clean Water Act Section 303(d) List of Water Quality–Limited Water Bodies—Lower Sacramento River and Its Tributaries (contd.)

Water Body	Beneficial Use Designations	Pollutant/ Stressor	Potential Sources	Affected Area/ Reach Length
Indian Valley Reservoir	MUN, AGR, PROC, POW, REC-1, REC-2, WARM, COLD, SPWN, WILD	Mercury	Resource extraction	3,469 acres
Cache Creek	MUN, AGR, PROC, IND, REC-1, REC-2, WARM, COLD (P), SPWN, WILD	Boron	Source unknown	96 miles
		Mercury	Resource extraction	
		Unknown toxicity	Source unknown	
Folsom Lake	MUN, AGR, IND (P), POW, REC-1, REC-2, WARM, COLD, SPWN, WILD	Mercury	Resource extraction	11,064 acres
American River	MUN, AGR, IND, POW, REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD	Mercury	Resource extraction	27 miles
		PCBs	Source unknown	
		Unknown toxicity	Source unknown	

Sources: SWRCB 2010a; Central Valley RWQCB 2009

Notes:
[1] Group A pesticides include one or more of the following compounds: aldrin, dieldrin, endrin, chlordane, lindane, heptachlor, heptachlorepoxide, endosulfan, and toxaphene.

Key:
(P) = Potential beneficial use
AGR = agricultural supply
COLD = cold freshwater habitat
DDT = dichloro-diphenyl-trichloroethane
Delta = Sacramento–San Joaquin Delta
IND = industrial service supply
MIGR = migration of aquatic organisms
MUN = municipal and domestic supply
NAV = navigation
PCBs = polychlorinated biphenyls
POW = hydropower generation
PROC = industrial process supply
REC-1 = water contact recreation
REC-2 = noncontact water recreation
SPWN = spawning, reproduction, and/or early development
WARM = warm freshwater habitat
WILD = wildlife habitat

Water quality conditions in the lower Sacramento River region are detailed below for the following areas listed in Table 3.21-2: the Sacramento River, Knights Landing to the Delta; Lake Oroville; the Feather River, Lake Oroville to the Sacramento River; New Bullards Bar Reservoir; the Yuba River, New Bullards Bar Reservoir to the Feather River; the Bear River, Camp Far West Reservoir to the Feather River; Indian Valley Reservoir; Cache Creek; Folsom Lake; and the American River. Water quality conditions in the Yolo Bypass are also summarized below, although the bypass does not appear in Table 3.21-2 because it is not included on the CWA Section 303(d) list.

Sacramento River, Knights Landing to the Delta Water quality parameters of concern in the lower Sacramento River between Knights Landing and the Delta consist of chlordane, DDT, dieldrin, mercury, PCBs, and unknown sources of toxicity.

Sediment transport in the Sacramento River from Knights Landing to the Delta is affected by historical hydraulic gold mining. The lower Sacramento River's major westerly flowing tributaries, such as the Feather, Yuba, Bear, and American rivers, have been particularly affected. However, sediment supply to the lower Sacramento River has declined over recent years because dams on tributaries and other water management actions have resulted in less sediment transport (CALFED 2000).

Lake Oroville and Feather River, Lake Oroville to the Sacramento River Like many Sierra Nevada foothill streams and rivers, the Feather River basin has historically been influenced by large-scale gold mining operations. However, water quality in the Feather River is generally suitable for most designated beneficial uses. The quality of water in Lake Oroville, formed by Oroville Dam on the Feather River, is highly influenced by the water quality of upstream tributaries (FERC 2007). Designated beneficial uses in Lake Oroville are limited by mercury and PCBs.

Feather River water quality downstream from Oroville Dam is determined largely by the quality of water released from Oroville Dam. Flow and water quality conditions in the lower Feather River are also influenced by flow from the Yuba and Bear rivers. Water quality in the Feather River, downstream from Oroville Dam to its confluence with the Sacramento River, is limited by chlorpyrifos, Group A pesticides, mercury, PCBs, and toxicity of unknown origin. (Group A pesticides include one or more of the following compounds: aldrin, dieldrin, endrin, chlordane, lindane, heptachlor, heptachlorepoxide, endosulfan, and toxaphene.) The primary source of mercury is abandoned mines; agricultural runoff is the source for pesticides. A TMDL for diazinon is in place for this reach (SWRCB 2010a).

New Bullards Bar Reservoir and Yuba River, New Bullards Bar Reservoir to the Feather River New Bullards Bar Dam, which forms New Bullards Bar Reservoir, is on the North Fork Yuba River and regulates flows for one-third of the Yuba River watershed. Water quality in New Bullards Bar Reservoir is limited by mercury. The overall water quality of the lower Yuba River below New Bullards Bar Reservoir is suitable for designated beneficial uses, and has improved in recent decades because hydraulic and dredge mining operations have been controlled and minimum instream flow requirements have been established (YCWA et al. 2007). Dissolved oxygen concentrations, total dissolved solids (TDS), pH, hardness, alkalinity, and turbidity are well within acceptable or preferred ranges for salmonids and other key freshwater biota (Reclamation et al. 2003). Changes in pesticide regulations have also improved local water quality. To date, no TMDLs have been developed or proposed for the Yuba River (YCWA et al. 2007).

Bear River, Camp Far West Reservoir to the Feather River Water quality in the Bear River is generally suitable for most designated beneficial uses. However, water quality concerns for the Bear River relate to the presence of chlorpyrifos, copper, diazinon, and mercury. The primary source of metals is abandoned mines; agriculture has been identified as the source for pesticides (SWRCB 2010a).

Indian Valley Reservoir and Cache Creek Water quality in both Indian Valley Reservoir and Cache Creek is limited by mercury related to historical mining activities. Mercury and methylmercury in the Cache Creek watershed affect aquatic ecosystems and bioaccumulate in higher trophic level organisms (Domagalski et al. 2004). Cache Creek is known to be a substantial source of mercury to the Yolo Bypass and lower Sacramento River. A TMDL and a Basin Plan amendment for mercury in Cache Creek were approved in 2007 (SWRCB 2010a). In addition to mercury, Cache Creek is impaired by boron and unknown toxicity.

Folsom Lake and American River American River water is generally characterized as high-quality surface water that is low in alkalinity, mineral content, and organic contamination (RWA et al. 2006). However, mercury resulting from historical mining activities is of concern in Folsom Lake and the American River downstream. PCBs and unknown toxicity also limit water quality in the American River downstream from Folsom Lake. A TMDL for mercury in the American River is currently under development (SWRCB 2010a).

Yolo Bypass During periods of diversion from the Sacramento River, the water chemistry in the Yolo Bypass is very similar to that in the river except along the western margin of the floodplain, where water chemistry is influenced by inflow from Cache and Putah creeks (USGS 2002). After diversion over the Fremont Weir ceases and floodwater within the bypass drains, chemical concentrations within the perennial channel of the Yolo Bypass is influenced by inflows from the local streams, which are sources of nutrient and contaminant loading (USGS 2002). Some contaminants from the Sacramento River can be trapped in the Yolo Bypass as the floodplain begins to drain. In addition, local stream inflows, irrigation return flows, and discharges from the local urban areas are potential sources of contaminants to the Yolo Bypass (USGS 2002). However, the Yolo Bypass is not listed on the CWA Section 303(d) list.

San Joaquin Valley and Foothills Surface water quality in the San Joaquin Valley and foothills is affected by several factors: natural runoff, agricultural return flows, construction, logging, grazing, operations of flow-regulating facilities, urbanization, and recreation (Reclamation 2011). In addition, irrigated crops grown in the western portion of the San Joaquin Valley have accelerated the leaching of minerals from soils, altering water quality conditions in the San Joaquin River system. Hydrologic features of the San Joaquin Valley and foothills are shown in Figure 3.21-2.

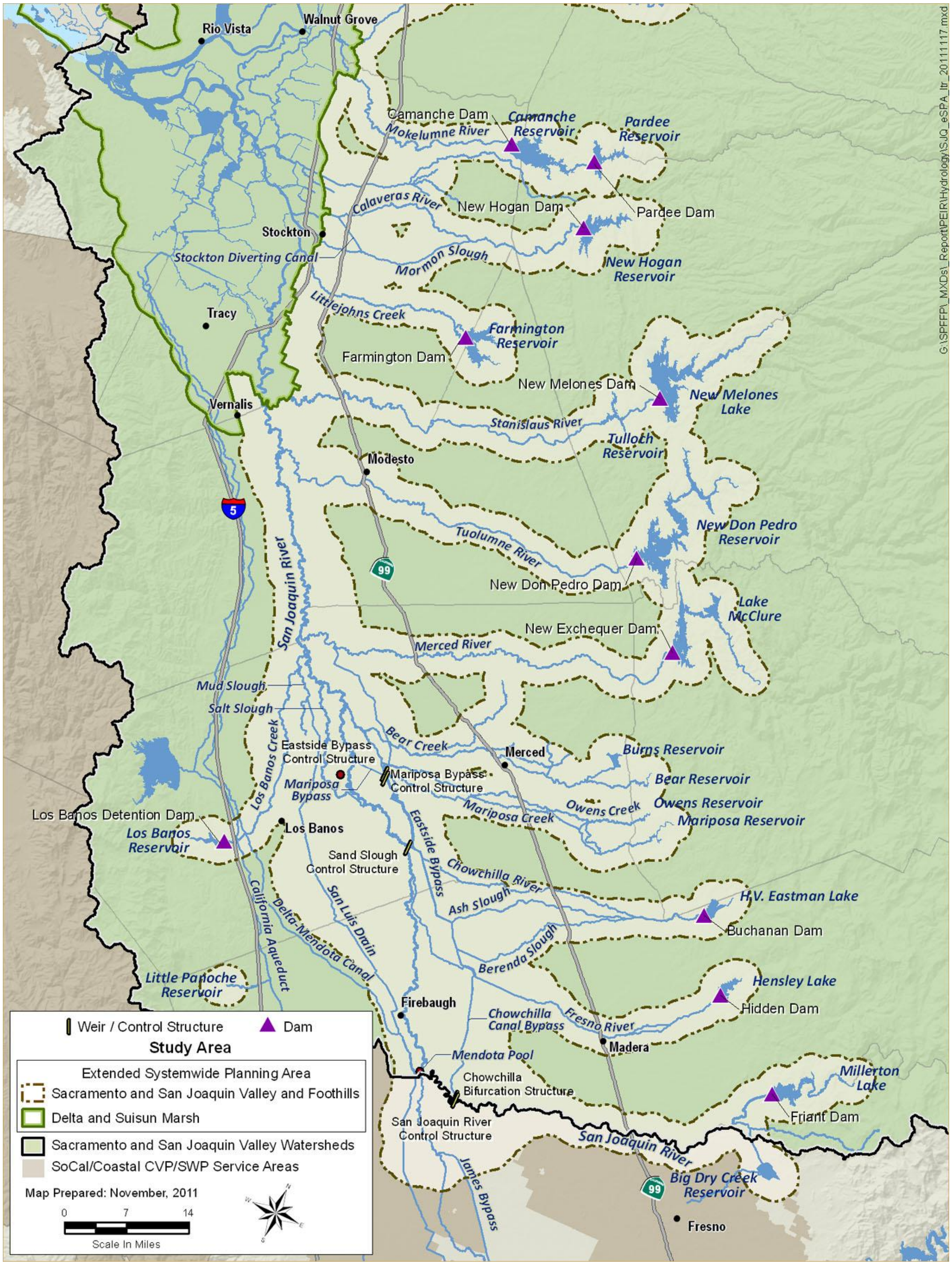

Figure 3.21-2. Hydrologic Features of the San Joaquin Valley and Foothills

Water quality in the San Joaquin River varies considerably along the river's length. In the reaches above Millerton Lake, water quality is generally suitable for most designated beneficial uses. Several reaches of the river below Friant Dam have frequently been dry historically, because of low flows and percolation to groundwater.

In the western part of the San Joaquin Valley, soils are derived mainly from the marine sediments that make up the Coast Ranges and are high in salts and trace elements, such as asbestos, selenium, molybdenum, arsenic, and boron. As the San Joaquin Valley has undergone extensive land development, erosion and drainage patterns have been altered, accelerating the rate at which these trace elements have been dissolved from the soil to accumulate in shallow groundwater, streams, and the San Joaquin River. Water quality characteristics of the upper San Joaquin River (Millerton Lake to the Merced River confluence) and its tributaries and the lower San Joaquin River (downstream from the Merced River confluence) and its tributaries are discussed separately below.

Upper San Joaquin River Water Bodies Water quality is degraded in various segments of the San Joaquin River between Friant Dam and the confluence with the Merced River because of low flow and discharges from agricultural areas and wastewater treatment plants. TMDL and Basin Plan amendments are in place for diazinon and chlorpyrifos runoff into the San Joaquin River. CWA Section 303(d) listings for the San Joaquin River and its tributaries between Millerton Lake and the confluence with the Merced River are listed in Table 3.21-3.

Table 3.21-3. Clean Water Act Section 303(d) List of Water Quality–Limited Water Bodies—Upper San Joaquin River and Its Tributaries

Water Body	Beneficial Use Designations	Pollutant/ Stressor	Potential Sources	Affected Area/ Reach Length
Millerton Lake	MUN (P), AGR, REC-1, REC-2, WARM, COLD (P), WILD	Mercury	Resource extraction	4,366 acres
San Joaquin River, Friant Dam to the Mendota Pool	MUN, AGR, PROC, REC-1, REC-2, WARM, COLD, MIGR, SPWN (P)[1], WILD	Invasive species	Source unknown	70 miles
San Joaquin River, Mendota Pool to Bear Creek	MUN (P), AGR, PROC, REC-1, REC-2, WARM, MIGR, SPWN (P)[1], WILD	Boron	Agriculture	88 miles
		Chlorpyrifos	Agriculture	
		DDT	Agriculture	
		Diazinon	Agriculture	
		Electrical conductivity	Agriculture	
		Group A pesticides[2]	Agriculture	
		Unknown toxicity	Source unknown	
Bear Creek	MUN (P), AGR, PROC, REC-1, REC-2, WARM, MIGR, SPWN (P)[1], WILD	*E. coli*	Source unknown	84 miles
		Unknown toxicity	Source unknown	
San Joaquin River, Bear Creek to Mud Slough	MUN (P), AGR, PROC, REC-1, REC-2, WARM, MIGR, SPWN (P)[1], WILD	Arsenic	Source unknown	14 miles
		Boron	Agriculture	
		Chlorpyrifos	Agriculture	
		DDT	Agriculture	
		Electrical conductivity	Agriculture	
		E. coli	Source unknown	
		Group A pesticides	Agriculture	
		Mercury	Resource extraction	
		Unknown toxicity	Source unknown	
Mud Slough, downstream from the San Luis Drain	AGR (L)[3], REC-1, REC-2, WARM, SPWN, WILD, COMM, SHELL	Boron	Agriculture	13 miles
		Electrical conductivity	Agriculture	
		Pesticides	Agriculture	
		Selenium	Agriculture	
		Unknown toxicity	Source unknown	

Table 3.21-3. Clean Water Act Section 303(d) List of Water Quality–Limited Water Bodies—Upper San Joaquin River and its Tributaries (contd.)

Water Body	Beneficial Use Designations	Pollutant/Stressor	Potential Sources	Affected Area/ Reach Length
Salt Slough	AGR, REC-1, REC-2, WARM, SPWN, WILD, COMM, BIOL, SHELL	Boron	Agriculture	9.9 miles
		Chlorpyrifos	Agriculture	
		Electrical conductivity	Agriculture	
		E. coli	Source unknown	
		Mercury	Resource extraction	
		Prometryn	Agriculture	
		Unknown toxicity	Agriculture	
San Joaquin River, Mud Slough to Merced River	MUN (P), AGR, PROC, REC-1, REC-2, WARM, MIGR, SPWN (P)[1], WILD	Boron	Agriculture	3 miles
		Chlorpyrifos	Agriculture	
		DDT	Agriculture	
		Diazinon	Agriculture	
		Electrical conductivity	Agriculture	
		E. coli	Source unknown	
		Group A pesticides	Agriculture	
		Mercury	Agriculture	
		Selenium	Agriculture	
		Unknown toxicity	Source unknown	

Sources: SWRCB 2010a; Central Valley RWQCB 2009

Notes:
[1] Potential beneficial use of spawning for cold-water salmon and steelhead, and existing beneficial use for warm-water striped bass, sturgeon, and shad.
[2] Group A pesticides include one or more of the following compounds: aldrin, dieldrin, endrin, chlordane, lindane, heptachlor, heptachlorepoxide, endosulfan, and toxaphene.
[3] Existing limited beneficial use for irrigation, and existing beneficial use for stock watering.

Key:
(L) = existing limited beneficial use
(P) = potential beneficial use
AGR = agricultural supply
BIOL = preservation of biological habitat of special significance
COLD = cold freshwater habitat
COMM = commercial and sport fishing
DDT = dichloro-diphenyl-trichloroethane
E. coli = *Escherichia coli*
MIGR = migration of aquatic organisms
MUN = municipal and domestic supply
PROC = industrial process supply
REC-1 = water contact recreation
REC-2 = noncontact water recreation
SHELL = shellfish harvesting
SPWN = spawning, reproduction, and/or early development
WARM = warm freshwater habitat
WILD = wildlife habitat

Water quality conditions in the upper San Joaquin River region are detailed below for the following areas listed in Table 3.21-3: Millerton Lake; the San Joaquin River, Friant Dam to the Mendota Pool; the San Joaquin River, Mendota Pool to Bear Creek; Bear Creek; the San Joaquin River, Bear Creek to Mud Slough; Mud Slough, downstream from the San Luis Drain; Salt Slough; and the San Joaquin River, Mud Slough to the Merced River. Water quality conditions in the Chowchilla, Eastside, and Mariposa bypasses are also summarized below, although the bypasses do not appear in Table 3.21-3 because they are not listed as impaired under CWA Section 303(d).

Millerton Lake Water quality in Millerton Lake is generally suitable for designated beneficial uses, although mercury has recently been identified as a concern. Water flowing into Millerton Lake is generally soft, with low mineral and nutrient concentrations because of the insolubility of granitic soils in the watershed and the river's granite substrate (SCE 2007). As the San Joaquin River flows from Millerton Lake across the eastern valley floor, its mineral concentration increases.

San Joaquin River, Friant Dam to the Mendota Pool Water quality in the reach from Friant Dam to the Mendota Pool is influenced by releases from Millerton Lake, with additional contributions from agricultural and urban return flows. Water quality data collected from the San Joaquin River below Friant Dam demonstrate the generally high quality of water released from Millerton Lake at Friant Dam. However, agricultural return flows contribute various pesticides, boron, and electrical conductivity (EC). Electrical conductivity is used as a measure of total dissolved solids or salinity in water. Portions of this reach historically were frequently dry except during flood releases at Friant Dam, because water released at Friant Dam is diverted upstream to satisfy water right agreements or the surface water percolates to groundwater. The temperatures of water released to the San Joaquin River from Friant Dam are dependent on the volume of cold water available at Millerton Lake (Reclamation 2007).

San Joaquin River, Mendota Pool to Bear Creek The reach of the San Joaquin River between the Mendota Pool and Bear Creek does not meet water quality criteria applicable to some designated beneficial uses because of toxicity from unknown sources and a range of agricultural contaminants—boron, chlorpyrifos, DDT, diazinon, EC, and Group A pesticides. TMDLs and Basin Plan amendments are being developed for selenium, salt and boron, and pesticides. During the irrigation season, water released at Mendota Dam generally has higher concentrations of TDS than water in the upper reaches of the San Joaquin River. Increased EC and concentrations of total suspended solids demonstrate the effect on San Joaquin River flow of Delta export contributions made via the Delta-Mendota Canal. Water temperatures below Mendota Dam are dependent on water temperatures of inflow from the Delta-Mendota Canal and, occasionally, the Kings River system via James Bypass (Reclamation 2007).

Bear Creek Water quality in Bear Creek does not meet water quality criteria for *Escherichia coli* (*E. coli*) and unknown toxicity.

San Joaquin River, Bear Creek to Mud Slough, and San Joaquin River, Mud Slough to the Merced River The portion of the San Joaquin River in these reaches has the poorest water quality of any reach of the river, because most of the flow in the river is derived from irrigation return flows carried by Salt and Mud sloughs (Reclamation 2011).Water quality in the San Joaquin River from Bear Creek to Mud Slough does not meet water quality criteria for arsenic, unknown toxicity, and multiple constituents related to agricultural return flows, including various pesticides, boron, and EC. Water quality in the reach from Mud Slough to the Merced River is limited by selenium, *E. coli*, mercury, and the above-listed agricultural contaminants. Water temperatures in the San Joaquin River between Bear Creek and the Merced River are influenced greatly by the water temperature of Salt Slough inflow, which contributes the majority of streamflow in the reach (Reclamation 2007).

Mud Slough, Downstream from the San Luis Drain, and Salt Slough Water quality in Mud Slough and Salt Slough is limited by boron, EC, pesticides, selenium, and unknown toxicity. Water quality in Salt Slough is also limited by *E. coli*, mercury, and prometryn. Additionally, current TMDLs address selenium from Salt Slough and the Grasslands Drainage Area.

Chowchilla, Eastside, and Mariposa Bypasses Water quality in the Chowchilla, Eastside, and Mariposa bypasses are affected by water quality in the upper San Joaquin River and its tributaries. The southernmost bypass, the Chowchilla Bypass, diverts San Joaquin River flow and sends it to the Eastside Bypass. Water quality in the Chowchilla Bypass is representative of water quality in the San Joaquin River from Friant Dam to the Mendota Pool. The Eastside Bypass extends from the confluence of the Fresno River and Chowchilla Bypass to its confluence with the San Joaquin River. Its water quality is representative of that of the Fresno River; Berenda Slough; Ash Slough; the Chowchilla River; and Deadman, Owens, and Bear creeks. The Mariposa Bypass delivers flow back to the San Joaquin River from the Eastside Bypass and has similar water quality. These bypasses are not listed as impaired under CWA Section 303(d) (SWRCB 2010a).

Lower San Joaquin River Water Bodies Below the confluence with the Merced River, water quality in the San Joaquin River generally improves at successive confluences with eastside rivers that drain the Sierra Nevada, particularly at the confluences with the Tuolumne and Stanislaus rivers. However, in the relatively long reach between the Merced and Tuolumne rivers, mineral concentrations tend to increase because of inflows of agricultural drainage water, wastewater treatment plant discharges, and effluent groundwater (groundwater that flows into surface waters) (Reclamation 2011).

The Central Valley RWQCB is developing a proposed Basin Plan amendment to establish new water quality objectives for salinity and boron in the lower San Joaquin River upstream from Vernalis, and a TMDL to implement those water quality objectives (SWRCB 2010a). Draft CWA Section 303(d) listings for the San Joaquin River from the Merced River to the Delta are provided in Table 3.21-4 (SWRCB 2010a).

Table 3.21-4. Clean Water Act Section 303(d) List of Water Quality–Limited Water Bodies—Lower San Joaquin River and Its Tributaries

Water Body	Beneficial Use Designations	Pollutant/Stressor	Potential Source	Affected Area/ Reach Length
Lake McClure	MUN (P), AGR, POW, REC-1, REC-2, WARM, COLD, WILD	Mercury	Resource extraction	5,605 acres
Merced River	MUN, AGR, PROC, IND, POW, REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD	Chlorpyrifos	Agriculture	50 miles
		Diazinon	Agriculture	
		E. coli	Source unknown	
		Group A pesticides[1]	Agriculture	
		Mercury	Resource extraction	
		Water temperature	Source unknown	
		Unknown toxicity	Source unknown	
San Joaquin River, Merced River to the Tuolumne River	MUN (P), AGR, PROC, REC-1, REC-2, WARM, MIGR, SPWN, WILD	alpha-BHC	Source unknown	29 miles
		Boron	Agriculture	
		Chlorpyrifos	Agriculture	
		DDE	Agriculture	
		DDT	Agriculture	
		Electrical conductivity	Agriculture	
		Group A pesticides[1]	Agriculture	
		Mercury	Resource extraction	
		Water temperature	Source unknown	
		Unknown toxicity	Agriculture	
New Don Pedro Reservoir	MUN (P), POW, REC-1, REC-2, WARM, COLD, WILD	Mercury	Resource extraction	11,056 acres
Tuolumne River	MUN (P), AGR, REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD	Chlorpyrifos	Agriculture	60 miles
		Diazinon	Agriculture	
		Group A pesticides[1]	Agriculture	
		Mercury	Resource extraction	
		Unknown toxicity	Source unknown	

Table 3.21-4. Clean Water Act Section 303(d) List of Water Quality–Limited Water Bodies—Lower San Joaquin River and Its Tributaries (contd.)

Water Body	Beneficial Use Designations	Pollutant/Stressor	Potential Source	Affected Area/ Reach Length
San Joaquin River, Tuolumne River to the Stanislaus River	MUN (P), AGR, PROC, REC-1, REC-2, WARM, MIGR, SPWN, WILD	Chlorpyrifos	Agriculture	8.4 miles
		DDT	Agriculture	
		Diazinon	Agriculture	
		Electrical conductivity	Agriculture	
		Group A pesticides[1]	Agriculture	
		Mercury	Resource extraction	
		Water temperature	Source unknown	
		Unknown toxicity	Agriculture	
New Melones Lake	MUN, AGR, POW, REC-1, REC-2, COLD, WILD	Mercury	Resource extraction	1,654 acres
Tulloch Reservoir	MUN (P), AGR, POW, REC-1, REC-2, WARM, WILD	Mercury	Source unknown	992 acres
Stanislaus River	MUN (P), AGR, PROC, IND, POW, REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD	Chlorpyrifos	Agriculture	59 miles
		Diazinon	Agriculture	
		Group A pesticides[1]	Agriculture	
		Mercury	Resource extraction	
		Unknown toxicity	Source unknown	
San Joaquin River, Stanislaus River to the Delta	MUN (P), AGR, PROC, REC-1, REC-2, WARM, MIGR, SPWN, WILD	Chlorpyrifos	Agriculture	3 miles
		DDE	Agriculture	
		DDT	Agriculture	
		Diuron	Agriculture	
		E. coli	Source unknown	
		Group A pesticides[1]	Agriculture	
		Mercury	Resource extraction	
		Water temperature	Source unknown	
		Toxaphene	Source unknown	
		Unknown toxicity	Agriculture	

Sources: SWRCB 2010a; Central Valley RWQCB 2009

Note:

[1] Group A pesticides include one or more of the following compounds: aldrin, dieldrin, endrin, chlordane, lindane, heptachlor, heptachlorepoxide, endosulfan, and toxaphene.

Key:
AGR = agricultural supply
alpha-BHC = alpha-benzene hexachloride
COLD = cold freshwater habitat
DDE = dichloro-diphenyl-dichloroethylene
DDT = dichloro-diphenyl-trichloroethane
E. coli = *Escherichia coli*
IND = industrial service supply
MUN = municipal and domestic supply
POW = hydropower generation
PROC = industrial process supply
REC-1 = water contact recreation
REC-2 = noncontact water recreation
WARM = warm freshwater habitat
MIGR = migration of aquatic organisms
SPWN = spawning, reproduction, and/or early development
WILD = wildlife habitat
(P) = potential beneficial use

Water quality conditions in the lower San Joaquin River region are detailed below for the following areas listed in Table 3.21-4: Lake McClure; the Merced River; the San Joaquin River, Merced River to Tuolumne River; New Don Pedro Reservoir; the Tuolumne River; the San Joaquin River, Tuolumne River to Stanislaus River; New Melones Lake; Tulloch Reservoir; the Stanislaus River, and the San Joaquin River, Stanislaus River to the Delta.

Lake McClure and the Merced River Water quality in Lake McClure, formed by New Exchequer Dam on the Merced River in the Sierra Nevada foothills, is limited by mercury because of historical mining activities (SWRCB 2010a). Water quality in the Merced River has been affected by a range of human activities: dam operations and flow regulation, flow diversion, gold and aggregate (sand and gravel) mining, levee construction, land use conversion in the floodplain, clearing of riparian vegetation, introduction of exotic plant and animal species, and point- and nonpoint-source pollution from abandoned mines. Effluent from wastewater treatment plants, bank protection, and recreational use are also potential factors affecting the range of biological and physical processes occurring in the Merced River watershed (East Merced Resource Conservation District 2008). Below New Exchequer Dam, water quality in the Merced River is affected by agricultural pesticides (chlorpyrifos, diazinon, and Group A pesticides), mercury from historical mining activities, water temperatures, *E. coli*, and unknown toxicity.

San Joaquin River, Merced River to the Tuolumne River Water quality in the San Joaquin River from the Merced River to the Tuolumne River is limited by alpha-BHC from unknown sources, agricultural constituents (chlorpyrifos, dichloro-diphenyl-dichloroethylene (DDE), DDT, EC, and Group A pesticides), mercury, water temperatures, and unknown toxicity.

New Don Pedro Reservoir and Tuolumne River As with other eastside tributaries to the San Joaquin River and Delta, water quality conditions in the Tuolumne River are generally suitable for designated beneficial uses. Water quality in New Don Pedro Reservoir in the Sierra Nevada foothills is affected by mercury from historical mining activities. Water quality in the Tuolumne River below New Don Pedro Dam is limited by agricultural pesticides (chlorpyrifos, diazinon, and Group A pesticides) and mercury.

San Joaquin River, Tuolumne River to the Stanislaus River Water quality in the San Joaquin River from the Tuolumne River to the Stanislaus River is limited by agricultural constituents (chlorpyrifos, DDT, diazinon, EC, and Group A pesticides), mercury, water temperatures, and unknown toxicity.

New Melones Lake, Tulloch Reservoir, and Stanislaus River As with the Tuolumne River, water flowing from the Sierra Nevada in the Stanislaus River is generally suitable for most designated beneficial uses. Water quality in New Melones Lake in the Sierra Nevada foothills, in Tulloch Reservoir, and in the Stanislaus River below New Melones Dam is impaired by mercury from historical mining activities (SWRCB 2010a).

San Joaquin River, Stanislaus River to the Delta Water quality in the San Joaquin River from the Stanislaus River to the Delta is limited by agricultural pesticides (chlorpyrifos, DDE, DDT, diuron, and Group A pesticides), *E. coli*, mercury, water temperatures, toxaphene, and unknown toxicity.

Eastside Tributaries to the Delta Eastside tributaries to the Delta are in the northern portion of the San Joaquin River basin, mostly between the watersheds of the American and Stanislaus rivers. These tributaries include Littlejohns Creek, New Hogan Reservoir, the lower Calaveras River, Pardee Reservoir, Camanche Reservoir, the lower Mokelumne River, and the lower Cosumnes River. CWA Section 303(d) listings for eastside tributaries to the Delta within the San Joaquin Valley and foothills are provided in Table 3.21-5.

Table 3.21-5. 2010 Clean Water Act Section 303(d) List of Water Quality–Limited Water Bodies—San Joaquin River Eastside Tributaries to the Delta

Water Body	Beneficial Use Designations	Pollutant/Stressor	Potential Sources	Area
Littlejohns Creek		*E. coli*	Source unknown	68 miles
		Unknown toxicity	Source unknown	
New Hogan Reservoir	REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD	Mercury	Resource extraction	3,180 acres
Calaveras River, lower	MUN, AGR, PROC (P), IND (P), REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD	Chlorpyrifos	Agriculture	28.6 miles
		Diazinon	Agriculture	
		Mercury	Resource extraction	
		Organic enrichment/ low dissolved oxygen	Urban runoff/ storm sewers	
		Pathogens	Urban runoff/ storm sewers	
		Unknown toxicity	Source unknown	

Table 3.21-5. 2010 Clean Water Act Section 303(d) List of Water Quality–Limited Water Bodies—San Joaquin River Eastside Tributaries to the Delta (contd.)

Water Bodies	Beneficial Use Designations	Pollutant/Stressor	Potential Sources	Area
Pardee Reservoir	MUN, POW, REC-1, REC-2, WARM, COLD, SPWN, WILD	Mercury	Resource extraction	2,185 acres
Camanche Reservoir	MUN, AGR, REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD	Copper	Resource extraction	7,389 acres
		Mercury	Resource extraction	
		Zinc	Resource extraction	
Mokelumne River, lower	AGR, REC-1, REC-2, WARM, COLD, MIGR, SPWN, WILD	Chlorpyrifos	Agriculture	34 miles
		Copper	Resource extraction	
		Mercury	Resource extraction	
		Oxygen, dissolved	Source unknown	
		Unknown toxicity	Source unknown	
		Zinc	Resource extraction	
Cosumnes River, lower	MUN, AGR, REC-1, REC-2, WARM, COLD, MIGR, SWPN, WILD	*E. coli*	Source unknown	36 miles
		Invasive species	Source unknown	
		Unknown toxicity	Agriculture	

Source: SWRCB 2010a; Central Valley RWQCB 2009

Key:
(P) = potential beneficial use
AGR = agricultural supply
alpha-BHC = alpha-benzene hexachloride
COLD = cold freshwater habitat
E. coli = Escherichia coli
IND = industrial service supply
MIGR = migration of aquatic organisms
MUN = municipal and domestic supply
POW = hydropower generation
PROC = industrial process supply
REC-1 = water contact recreation
REC-2 = noncontact water recreation
SPWN = spawning, reproduction, and/or early development
WARM = warm freshwater habitat
WILD = wildlife habitat

Little additional information beyond draft CWA Section 303(d) listings is available for the eastside tributaries to the Delta, which tend to have similar water quality issues. Water quality issues for this geographic area are therefore discussed as a whole.

In general, water quality in Littlejohns Creek and the Calaveras, Mokelumne, and Cosumnes rivers and their associated reservoirs is limited by agricultural pesticides, metals from historical mining activities, and pathogens and low dissolved oxygen resulting from urban stormwater runoff. Reservoirs on these rivers are impaired by metals from historical mining activities.

Delta Water quality issues in the Delta are complex and include multiple concerns in addition to those identified on the CWA Section 303(d) list. CWA Section 303(d) listings and concerns are similar throughout the various regions of the Delta. As a result, tables showing draft CWA Section 303(d) listings for various waterways and regions of the Delta are not included in this section. The following discussion broadly covers water quality issues of concern throughout the various Delta waterways, shown in Figure 3.21-3.

Water quality in the Delta is highly variable temporally and spatially. It is a function of complex circulation patterns affected by inflows, pumping for Delta agricultural operations and exports, operation of flow management structures, and tidal action (SWRCB 1999). The beneficial uses vary throughout the Delta and are to be evaluated on a case-by-case basis. The overall list of beneficial uses available in various parts of the Delta are municipal and domestic supply; agricultural supply; industrial process supply; industrial service supply; contact and noncontact water recreation; warm and cold freshwater habitat; migration of aquatic organisms, spawning, reproduction, and/or early development of fish; wildlife habitat; and navigation.

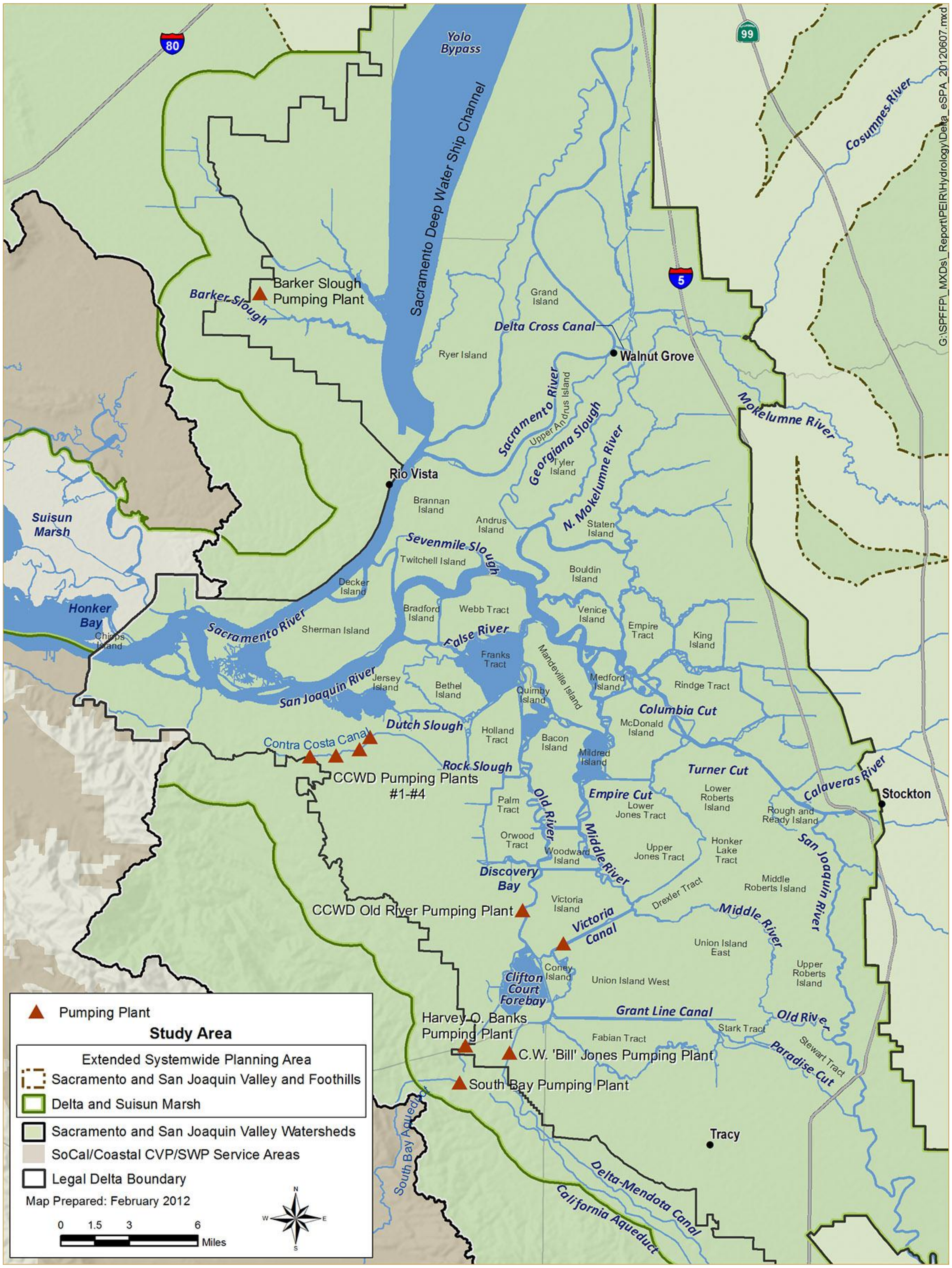

Figure 3.21-3. Hydrologic Features of the Delta

The following are key water quality issues in the Delta (Reclamation and DWR 2005; CALFED 2000):

- Return flows from agricultural drainage, and groundwater seepage have introduced toxic substances into the Delta—specifically, high levels of nutrients, suspended solids, dissolved organic carbon and minerals, and pesticides.
- Historical drainage and sediment discharged from upstream mining operations in the late 1800s and early 1900s have contributed metals, such as cadmium, copper, and mercury.
- Stormwater runoff can contribute metals, sediment, pathogens, organic carbon, nutrients, pesticides, dissolved solids (salts), petroleum products, and other chemical residues.
- Wastewater discharges from treatment plants can contribute salts, metals, trace organics, nutrients, pathogens, pesticides, organic carbon, and oil and grease.
- Synthetic organic chemicals and heavy metals have bioaccumulated in Delta fish and other aquatic organisms, occasionally exceeding standards for food consumption.
- The San Joaquin River delivers relatively poor-quality water to the Delta; agricultural drainage is a major source of salts, metals, and other pollutants. Because the south Delta receives a substantial portion of water from the San Joaquin River, the influence of this relatively poor San Joaquin River water quality is greatest in the south Delta channels and in CVP and SWP exports.
- Delta exports contain elevated concentrations of disinfection byproduct precursors (e.g., dissolved organic carbon), and the presence of bromide increases the potential for formation of brominated compounds in treated drinking water.

The Sacramento and San Joaquin rivers contribute approximately 61 percent and 33 percent, respectively, to TDS concentrations from tributary inflows within the Delta. TDS concentrations are relatively low in the Sacramento River, but because of its large volumetric contribution, the river provides the majority of the TDS load supplied by tributary inflow to the Delta (DWR 2001). Although actual flow from the San Joaquin River is lower than flow from the Sacramento River, TDS concentrations in San Joaquin River water average approximately seven times those in the Sacramento River. The influence of this relatively poor water quality in the

San Joaquin River is greatest in the south Delta channels and in CVP and SWP exports.

Delta salinity is influenced by tidal action and return flows from agricultural and urbanized lands. High-salinity waters from Suisun Bay intrude into the Delta during periods of low Delta outflow and can adversely affect agricultural and municipal uses. The highest salinity concentrations typically occur in late summer or early fall.

Mercury methylation is another major challenge to water quality throughout the Delta region. Delta areas that are intermittently flooded, such as tidally influenced shallow-water habitats, can be primary sites for mercury methylation. The methylation process converts inorganic mercury found in sediment deposits into methylmercury, which is a toxic substance that affects wildlife and human health. In addition, synthetic organic chemicals, particularly chlorinated pesticides and heavy metals, accumulate in Delta fish in quantities that occasionally exceed acceptable standards for human consumption (EBMUD 2009). A Basin Plan amendment and a TMDL for methylmercury in the Delta are in place.

Industrial and municipal discharges from wastewater treatment plants are strictly regulated to minimize adverse impacts on water quality; however, these discharges are not regulated for organic carbon and pathogenic protozoa, two important potential contaminants of drinking water. Much of the runoff from urban and agricultural areas is unregulated and more difficult to control. Runoff containing oil, grease, metals, pesticides, fertilizers, and many other pollutants contributes to the pollution of Delta and San Francisco Bay waters (CALFED 2000). Discharges from wastewater treatment facilities affect inorganic nutrient concentrations and may have an effect on primary production processes in the Delta (SWRCB 2010b).

High loads of oxygen-demanding substances, in addition to low flows and channel geometry, contribute to low oxygen levels in the Stockton Deep Water Ship Channel (Central Valley RWQCB 2005). A TMDL and Basin Plan amendment have been established for organic enrichment and low dissolved oxygen in the Stockton Deep Water Ship Channel portion of the San Joaquin River.

Recreational uses also contribute to degradation of Delta water quality. The key contaminants associated with recreational uses are pathogens caused by human and animal sources, and oil, grease, fuel, and fuel additive discharges from recreational vehicles (CALFED 2000).

Delta waterways fall within the jurisdiction of both the Central Valley RWQCB and the San Francisco Bay RWQCB. Various Delta waterways in the area under the jurisdiction of the Central Valley RWQCB are listed under CWA Section 303(d) as impaired for low dissolved oxygen, EC, mercury, Group A pesticides, chlorpyrifos, diazinon, DDT, dieldrin, dioxin, furan compounds, PCBs, unknown toxicity, pathogens, and invasive species (SWRCB 2010a). Delta waterways in the area under the jurisdiction of the San Francisco Bay RWQCB are listed under CWA Section 303(d) as impaired for chlordane, DDT, dieldrin, dioxin compounds, furan compounds, invasive species, mercury, PCBs, and selenium (SWRCB 2010a).

Suisun Marsh Suisun Marsh is listed under CWA Section 303(d) by the San Francisco Bay RWQCB as impaired for mercury, nutrients, low dissolved oxygen, and salinity (SWRCB 2010a). Salinity in the marsh is governed primarily by Delta outflow and varies seasonally, with higher salinities in summer and fall, and lower salinities in winter and spring. Sloughs in the marsh are used to flood and drain managed wetlands in support of habitat for resident and migratory wildlife and waterfowl hunting. Increased salinity in water used in managed wetlands inhibits wetland diversity and the productivity of food plants intended to attract waterfowl species. Hydrologic features of Suisun Marsh are shown in Figure 3.21-4.

Other water quality pollutants in Suisun Marsh include elevated water temperature and increased levels of suspended sediment. Thermal discharges into Suisun Bay from power-generating stations along the Contra Costa shoreline can elevate water temperatures (Engle et al. 2010) and can alter the environment’s biochemical processes and the behavior and physiology of marine organisms (Hanson et al. 2003). Suisun Bay, which borders Suisun Marsh to the south, is listed by the San Francisco Bay RWQCB as impaired for chlordane, DDT, dieldrin, dioxin compounds, furan compounds, invasive species, mercury, PCBs, and selenium (SWRCB 2010a).

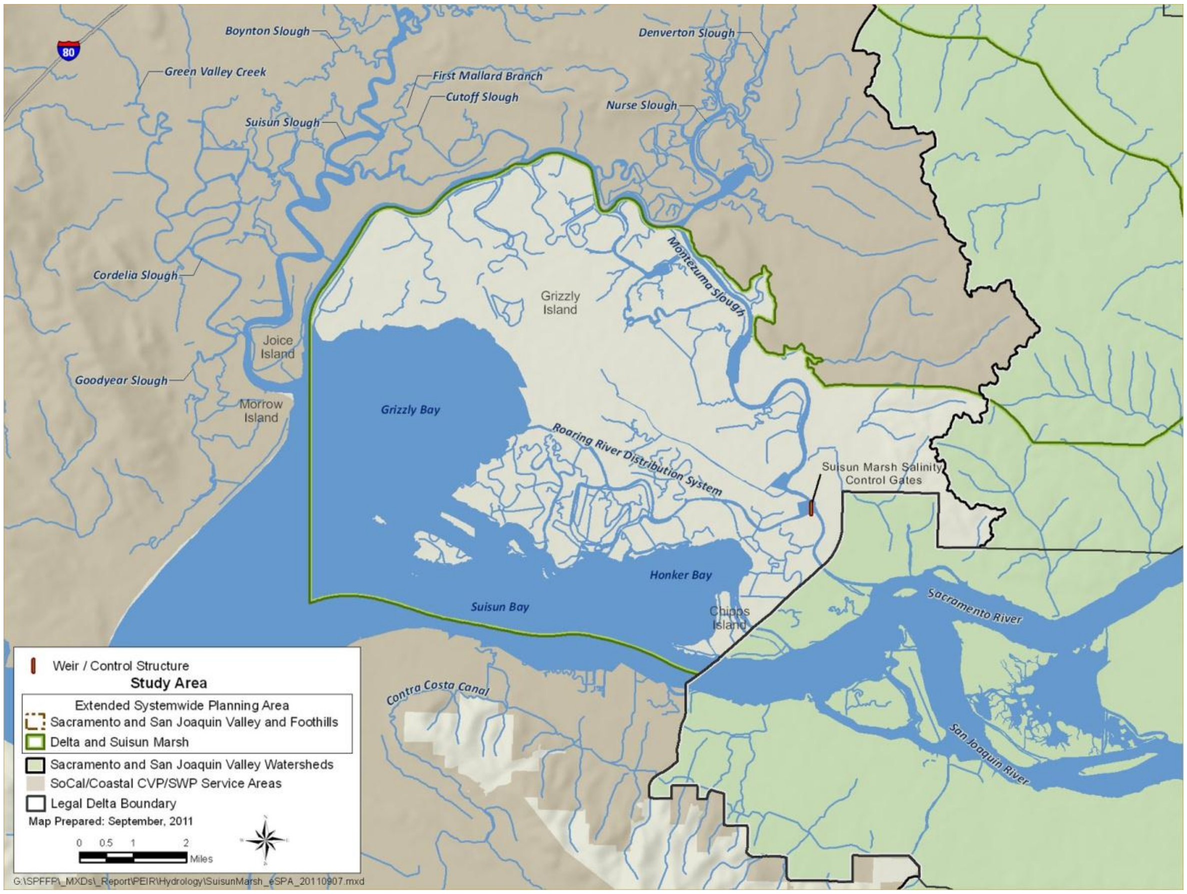

Figure 3.21-4. Hydrologic Features of the Suisun Marsh

Sacramento and San Joaquin Valley Watersheds

Water flowing from the Cascade Range and Sierra Nevada into the rivers and reservoirs of the Extended SPA is generally suitable for all designated beneficial uses. Surface water quality in the Sacramento and San Joaquin Valley watersheds is affected by several factors: natural runoff, agricultural return flows, historical mining activities, logging, grazing, operations of flow-regulating facilities, urban stormwater runoff, and recreation. Water quality in the Sacramento and San Joaquin Valley watersheds outside of the Extended SPA is unlikely to be affected by program implementation. Therefore, this geographic area is not discussed in detail.

SoCal/Coastal CVP/SWP Service Areas

As stated previously, because the proposed program is not expected to have adverse effects on water quality within the SoCal/coastal CVP/SWP service areas, water quality in these service areas is not discussed in detail.

The quality of water delivered to the SoCal/coastal CVP/SWP service areas is affected by fluctuations in Delta water quality, which in turn are influenced by climate, water quality in the Sacramento and San Joaquin rivers, local agricultural diversions and drainage water, urban runoff, and discharges from wastewater treatment facilities. Salinity and constituents that affect the quality of drinking water are of particular concern. Salinity is an issue because excessive salinity may adversely affect crop yields and require more water for salt leaching, may require additional municipal and industrial treatment, may increase salinity levels in agricultural soils and groundwater, and is the primary water quality constraint to recycling wastewater. Constituents that affect the quality of drinking water include bromide, natural organic matter, microbial pathogens, nutrients, TDS, hardness, alkalinity, pH, and turbidity (CALFED 2000).

The Friant Division is operated independently of the rest of the CVP. The quality of water from Millerton Lake delivered to Friant Division contractors via the Friant-Kern and Madera canals is representative of water quality conditions at Millerton Lake and the upper San Joaquin River watershed—generally soft with low mineral and nutrient concentrations.

Water from the Delta is delivered to Arvin-Edison Water Service District via the California Aqueduct in exchange for water delivered from Millerton Lake, when conditions permit. The quality of water delivered to Arvin-Edison Water Service District is representative of a mixture of Delta and Millerton Lake water quality conditions, as described above (Reclamation 2011).

3.21.2 Regulatory Setting

The following text summarizes federal, State, and regional and local laws and regulations pertinent to evaluation of the proposed program's impacts on water quality conditions.

Federal

Clean Water Act, Section 401 See Subsection 3.5.2, "Regulatory Setting," in Section 3.5, "Biological Resources—Aquatic."

Clean Water Act, Section 402 See Subsection 3.5.2, "Regulatory Setting," in Section 3.5, "Biological Resources—Aquatic."

Clean Water Act, Section 404 See Subsection 3.5.2, "Regulatory Setting," in Section 3.5, "Biological Resources—Aquatic."

National Toxics Rule The National Toxics Rule was established under Section 303(c)(2)(b) of the CWA. Promulgated in 1992, the National Toxics Rule sets numeric criteria for priority toxic pollutants for 14 states not currently in compliance with Section 303(c)(2)(b). California was one of the states determined to be out of compliance because criteria had not been established for some pollutants. California established statewide water quality criteria with the California Toxics Rule (CTR) in 2000; these criteria are legally applicable in California for inland surface waters, enclosed bays, and estuaries for all purposes and programs under the CWA. (See the discussion of the CTR under the discussion of State regulations, below.)

Safe Drinking Water Act The Safe Drinking Water Act (SDWA) was passed by Congress in 1974, then amended in 1986 and 1996, to protect public health by regulating the nation's public drinking-water supply. The SDWA requires many actions to protect drinking water and its sources: rivers, lakes, reservoirs, springs, and groundwater wells. The law authorizes the U.S. Environmental Protection Agency (EPA) to set national health-based standards for drinking water to protect against both naturally occurring and human-made contaminants that may be found in drinking water. Drinking-water standards that include maximum contaminant levels (MCL) and treatment requirements are set for approximately 90 contaminants in drinking water. Water suppliers may not provide water that does not meet these standards. Every state must assess its sources of drinking water to identify important potential sources of contamination and determine the susceptibility of the sources to these threats.

Rivers and Harbors Act See Subsection 3.5.2, "Regulatory Setting," in Section 3.5, "Biological Resources—Aquatic."

Federal Antidegradation Policy The federal antidegradation policy is designed to provide the level of water quality necessary to protect existing uses and provide protection for higher quality and national water resources. The policy directs states to adopt a statewide policy that includes the following primary provisions (40 Code of Federal Regulations (CFR) 131.12):

> *1. Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.*
>
> *2. Where the quality of waters exceed levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the State finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the State's continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located.*

> *3. Where high quality waters constitute an outstanding National resource, such as waters of National and State parks and wildlife refuges and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected.*

Long-Term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region The Long-Term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region (LTMS) is a cooperative effort of EPA, the U.S. Army Corps of Engineers, the State Water Resources Control Board (SWRCB), the San Francisco Bay RWQCB, and the San Francisco Bay Conservation and Development Commission to develop a new approach to dredging and disposal of dredged materials in the San Francisco Bay Area. An average of 6 million cubic yards of sediments must be dredged every year to maintain safe navigation in and around San Francisco Bay, resulting in controversy surrounding appropriate management of such an effort. The following are the major goals of the LTMS (EPA 1998):

1. Maintain in an economically and environmentally sound manner those channels necessary for navigation in San Francisco Bay and Estuary and eliminate unnecessary dredging activities in the Bay and Estuary.

2. Conduct dredged material disposal in the most environmentally sound manner.

3. Maximize the use of dredged material as a resource.

4. Establish a cooperative permitting framework for dredging and dredged material disposal applications.

Federal Surface Water Treatment Rule EPA promulgated the Surface Water Treatment Rule (SWTR) in June 1989 to protect against *Giardia lamblia*, *legionella* (a bacterium), and viruses in the nation’s surface-water sources of drinking water and in groundwater sources influenced by surface water. These contaminants were included on the list of 83 contaminants under EPA regulation, according to the 1986 SDWA amendments. The SWTR defines criteria for determining when filtration is required for surface waters, establishes minimum levels of disinfection for surface waters, and establishes a treatment technique for address the above listed pathogens.

In July 1995, EPA proposed the Enhanced Surface Water Treatment Rule as an amendment to the SWTR. The amendment provides additional protection against disease-causing organisms such as *Giardia lamblia*, *Cyptosporidium parvum*, and viruses in drinking water. The Enhanced

Surface Water Treatment Rule outlines several alternatives for treatment requirements based on source-water concentrations for these pathogens.

EPA has delegated to the California Department of Public Health's Division of Drinking Water and Environmental Management the responsibility for administering California's drinking-water program.

Disinfectant and Disinfection Byproducts Rule The 1986 amendments to the federal SDWA required EPA to propose a rule for disinfectants and disinfection byproducts to protect sources of drinking water. The rule must balance the need for protection from cancer-causing chemicals (byproducts) with the need for protection from pathogenic microbes (bacteria, viruses, and protozoans) that are killed by disinfection. In 1992, EPA began a rulemaking process called the "Reg-Neg" process. Negotiators in the process included staff members from state and local health and regulatory agencies, elected officials, consumer groups, environmental groups, and representatives from public water systems. The Reg-Neg process resulted in a two-stage approach for regulation development. Treatment requirements of the Stage 1 and Stage 2 Disinfectants and Disinfection Byproduct Rule are based on municipal source water quality.

The Stage 1 Disinfectant and Disinfection Byproduct Rule was promulgated in November 1998. Compounds affected under Stage 1 regulations of the Disinfectant and Disinfection Byproduct Rule include total trihalomethanes, total haloacetic acids, total organic carbon, bromate, chlorine, chloramines, chlorine dioxide, and chlorite. Drinking-water treatment operators are required under these regulations to monitor and limit these constituents of concern.

The Stage 2 Disinfectants and Disinfection Byproducts Rule was promulgated in 2006. This final rule requires systems that deliver disinfected water to meet maximum contaminant levels as an average at each compliance monitoring location (instead of as a systemwide average as in previous rules) for two groups of disinfection byproducts, trihalomethanes and five haloacetic acids. The rule targets systems with the greatest risk and builds incrementally on existing rules. The rule also contains a risk-targeting approach to better identify monitoring sites where customers are exposed to high levels of disinfection byproducts.

Comprehensive Environmental Response Compensation and Liability Act The Comprehensive Environmental Response Compensation and Liability Act (CERCLA), also known as the Superfund Act (42 U.S. Code 9601 et seq.; 27, 40 CFR), provides for the liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and the cleanup of inactive hazardous-waste disposal sites. CERCLA authorized the National Priorities List, which identifies contaminated sites that are eligible for remedial action. The scope of CERCLA is broad; it holds current and prior owners and operators of contaminated sites responsible, and its definition of a hazardous substance incorporates definitions from the federal Clean Air Act, the CWA, the Toxic Substances Control Act, and the Resource Conservation and Recovery Act (CERCLA Section 101(14)). EPA is the agency responsible for administering CERCLA.

Federal Insecticide, Fungicide, and Rodenticide Act and Federal Environmental Pesticide Control Act The Federal Environmental Pesticide Control Act was enacted in 1972 to amend the Federal Insecticide, Fungicide, and Rodenticide Act, which was enacted in 1947 to control the use of pesticides. As amended, the Federal Environmental Pesticide Control Act is enforced by EPA with a focus on minimizing risks associated with toxicity and environmental degradation, rather than on improving pesticide effectiveness. People or companies that violate pesticide regulations may be issued a civil administrative complaint by EPA. The complaint may include a civil penalty and/or a requirement to correct the violation. A "Stop Sale, Use or Removal" order may also be issued by EPA to the individual or company that owns, has custody of, or controls a pesticide in violation, thereby restricting the sale or use of the product.

State

Porter-Cologne Water Quality Control Act See Subsection 3.5.2, "Regulatory Setting," in Section 3.5, "Biological Resources—Aquatic."

Statement of Policy with Respect to Maintaining High Quality Waters in California (SWRCB Resolution No. 68-16) The State's antidegradation policy protects water bodies where existing quality is higher than necessary for the protection of beneficial uses. Under the antidegradation policy, any actions that can adversely affect water quality in all surface and ground waters must be consistent with maximum benefit to the people of the State, must not unreasonably affect present and anticipated beneficial use of the water, and must not result in water quality less than that prescribed in water quality plans and policies. In addition, any activity resulting in discharge of waste to existing high-quality waters will be required to meet waste discharge requirements, which will result in the best practicable treatment or control of the discharge necessary to assure that a pollution or nuisance will not occur and that the highest water quality consistent with maximum benefit to the people of the State will be maintained.

Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta Estuary The current basin plan in effect in the Delta is the 2006 *Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta Estuary* (WQCP) (SWRCB 2006). The WQCP identifies beneficial uses of water in the Delta to be protected, water quality objectives for the reasonable protection of beneficial uses, and an implementation program to achieve the water quality objectives.

Water Rights Decision 1641 Although the WQCP (discussed above) outlines current water quality objectives for the Delta, SWRCB Decision 1641 (D-1641) contains the current water right requirements to implement the Bay-Delta water quality objectives. D-1641 focuses primarily on CVP and SWP diversions, permitting some changes in use and, importantly, specifying salinity limits. It identifies standards for compliance for WQCP objectives relating to the location of X2, or the position at which 2 parts per thousand salinity occurs in the Delta estuary.

Water Quality Control Plan for the Sacramento and San Joaquin River Basins The basin plan for the Central Valley RWQCB (referred to in this section as “the Basin Plan”) covers an area including the entire Sacramento and San Joaquin river basins, involving an area bounded by the crests of the Sierra Nevada to the east and the Coast Ranges and Klamath Mountains to the west. The proposed program must meet the water quality objectives in the Basin Plan, which was designed to protect the beneficial uses of the Sacramento and San Joaquin rivers and their tributaries, and was last amended in 2009.

San Francisco Bay Basin Water Quality Control Plan The current basin plan for Suisun Marsh is the *San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan)*. This basin plan covers 1,100 square miles of the 1,600-square-mile San Francisco Bay estuary and includes coastal portions of Marin and San Mateo counties, from Tomales Bay in the north to Pescadero and Butano creeks in the south. The bay system functions as the only drainage outlet for waters of the Central Valley. It also serves as a natural topographic separator between the northern and southern Coast Ranges.

Suisun Marsh Preservation Agreement The *Suisun Marsh Preservation Agreement* is discussed in Subsection 3.11.2, “Regulatory Setting, in Section 3.11, “Groundwater Resources.”

California Toxics Rule As mentioned previously, the CTR was established because of requirements of the National Toxics Rule. On May 18, 2000, EPA established numeric water quality criteria for priority toxic pollutants and other provisions for water quality standards to be applied to waters in California. The CTR promulgated ambient aquatic-life criteria for 23 priority toxics and ambient human-health criteria for 57 priority toxics. It also includes a compliance schedule provision, which authorizes the State to issue schedules of compliance for new or revised National Pollutant Discharge Elimination System (NPDES) permit limits based on federal criteria when certain conditions are met. The CTR will serve as a placeholder until the State readopts its own numeric criteria for toxics. The State must use the criteria together with its existing water quality standards when controlling pollution in inland waters and enclosed bays and estuaries. The numeric water quality criteria contained in the final rule are identical to EPA's recommended CWA Section 304(a) criteria for these pollutants, published in December 1998 (see 63 CFR 68353).

California Water Code See Subsection 3.5.2, "Regulatory Setting," in Section 3.5, "Biological Resources—Aquatic."

Groundwater Management Act See Subsection 3.11.2, "Regulatory Setting," in Section 3.11, "Groundwater Resources."

Regional and Local

Each county in the study area has a general plan that includes numerous policies to protect water quality, water supply, water resources, and watersheds. Local policies included in general plans for counties in the study area related to surface water quality are consistent with federal and State regulations described above, and CEQA policy to prevent environmental damage. No specific local requirements are pertinent to this analysis.

Should a placed-based project be defined and pursued as part of the proposed program, and should the CEQA lead agency be subject to the authority of local jurisdictions, the applicable county and city policies and ordinances would be addressed in a project-level CEQA document as necessary.

3.21.3 Analysis Methodology and Thresholds of Significance

This section provides a program-level evaluation of the direct and indirect effects on water quality conditions of implementing management actions included in the proposed program. These proposed management actions are expressed as NTMAs and LTMAs. The methods used to assess how different categories of NTMAs and LTMAs could affect water quality conditions are summarized in "Analysis Methodology"; thresholds for evaluating the significance of potential impacts are listed in "Thresholds of Significance." Potential effects related to each significance threshold are discussed in Section 3.21.4, "Environmental Impacts and Mitigation

Measures for NTMAs," and Section 3.21.5, "Environmental Impacts, Mitigation Measures, and Mitigation Strategies for LTMAs."

Analysis Methodology

Impact evaluations were based on a review of the management actions proposed under the CVFPP, expressed as NTMAs and LTMAs in this PEIR, to determine whether these actions could result in impacts on water quality conditions. NTMAs and LTMAs are described in more detail in Section 2.4, "Proposed Management Activities." The overall approach to analyzing the impacts of NTMAs and LTMAs and providing mitigation is summarized below and described in detail in Section 3.1, "Approach to Environmental Analysis." NTMAs are evaluated at a greater level of specificity than LTMAs for the following reasons:

- NTMAs are better defined and less conceptual than LTMAs, are more likely to be implemented in the short term (within the first 5 years after approval of the CVFPP), and are generally less complex.
- NTMAs have more secure funding sources than LTMAs.
- Environmental impacts of NTMAs can generally be evaluated more accurately than impacts of LTMAs.

NTMAs can consist of any of the following types of activities:

- Improvement, remediation, repair, reconstruction, and operation and maintenance of existing facilities
- Construction, operation, and maintenance of small setback levees
- Purchase of easements and/or other interests in land
- Operational criteria changes to existing reservoirs that stay within existing storage allocations
- Implementation of the vegetation management strategy included in the CVFPP
- Initiation of conservation elements included in the proposed program
- Implementation of various changes to DWR and Statewide policies that could result in alteration of the physical environment

All other types of CVFPP activities fall within the LTMA category. However, NTMA-type activities (e.g., remediation of existing levees) would continue to be implemented in the CVFPP study area into the longer term time frame of the LTMAs.

NTMAs are evaluated using a typical "impact/mitigation" approach. Where impact descriptions and mitigation measures identified for NTMAs also apply to LTMAs, they are also attributed to LTMAs, with modifications or expansions as needed. However, because many LTMAs are more general and conceptual, additional impacts are described in a broader narrative format. Impacts of LTMAs that are addressed in this narrative format are those considered too speculative for detailed evaluation, consistent with Section 15145 of the CEQA Guidelines. Following the narrative description of these additional impacts is a list of suggested mitigation strategies that could be employed, indicating the character and scope of mitigation actions that might be implemented if a future project-specific CEQA analysis were to find these impacts to be significant.

Implementation of the proposed program would result in construction-related, operational, and maintenance-related impacts on water quality. This analysis evaluates the potential for construction, operations, and maintenance to affect water quality conditions in the study area.

Thresholds of Significance

The following applicable thresholds of significance have been used to determine whether implementing the proposed program would result in a significant impact. These thresholds of significance are based on Appendix G of the State CEQA Guidelines, as amended. A water quality impact is considered significant if implementation of the proposed program would do any of the following when compared against existing conditions:

- Violate applicable water quality standards or otherwise substantially degrade water quality

- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in a substantial increase in the availability and mobilization of sediments and associated contaminants

3.21.4 Environmental Impacts and Mitigation Measures for NTMAs

This section describes the physical effects of NTMAs on water quality conditions. For each impact discussion, the environmental effect is determined to be either less than significant, significant, potentially significant, or beneficial compared to existing conditions and relative to the thresholds of significance described above. These significance categories are described in more detail in Section 3.1, "Approach to Environmental Analysis."

Feasible mitigation measures are identified to address impacts identified as significant or potentially significant. The specificity of the mitigation measures is consistent with the broad, program-level nature of the CVFPP and the parallel program-level analysis in this PEIR. Mitigation measures identified in this PEIR would be applied as appropriate to specific future projects implemented under the CVFPP. Actual implementation, monitoring, and reporting of the PEIR mitigation measures would be the responsibility of the project proponent for each site-specific project. For those projects not undertaken by, or otherwise subject to the jurisdiction of, DWR or the Board, the project proponent generally can and should implement all applicable and appropriate mitigation measures. The project proponent is the entity with primary responsibility for implementing specific future projects and may include DWR; the Board; reclamation districts; local flood control agencies; and other federal, State, or local agencies. Because various agencies may ultimately be responsible for implementing (or ensuring implementation of) mitigation measures identified in this PEIR, the text describing mitigation measures below does not refer directly to DWR but instead refers to the "project proponent." This term is used to represent all potential future entities responsible for implementing, or ensuring implementation of, mitigation measures.

Impact SWQ-1 (NTMA): ***Temporary Construction-Related Effects on Water Quality that Would Not Cause Violations of Existing Water Quality Standards or Otherwise Substantially Degrade Water Quality***

NTMAs in which channels and structures would be modified could temporarily affect water quality in the Extended SPA during construction. Ground-disturbing activities could cause soil erosion and sedimentation in rivers and other nearby water bodies. Construction activities could also discharge wastes, petroleum products, or other construction-related substances that could enter waterways in runoff. In addition, chemicals used in operating heavy machinery would be used, transported, and stored on project sites during construction activities. These substances could be inadvertently introduced into rivers through site runoff or on-site spills. Sediment and chemicals could degrade water quality.

Construction activities associated with the proposed program are subject to construction-related stormwater permit requirements of the federal CWA's NPDES program. The project proponent would obtain any required permits for site-specific projects from the Central Valley RWQCB before beginning any ground-disturbing construction activity.

To meet NPDES requirements, storm water pollution prevention plans (SWPPPs) would be prepared for NTMAs, identifying best management practices (BMPs) to prevent or minimize the introduction of contaminants into surface waters. BMPs for the project could include but would not be limited to silt fencing, straw bale barriers, fiber rolls, storm drain inlet protection, hydraulic mulch, and stabilized construction entrances. Each SWPPP would include site-specific structural and operational BMPs to prevent and control effects on runoff quality, along with measures to be implemented before each storm event. The SWPPPs would require that BMPs be inspected and maintained, and that the quality of runoff be monitored by visual and/or analytical means. See also Impact HYD-1 (NTMA) and Mitigation Measure HYD-1 (NTMA) in Section 3.13, "Hydrology," for a discussion of the potential for changes in erosion or siltation to affect hydrology.

Because construction activities would be subject to stormwater permit requirements, this impact would be **less than significant**. No mitigation is required.

Impact SWQ-2 (NTMA): ***Modification of Reservoir Operations that Would Not Cause Violations of Existing Water Quality Standards or Otherwise Substantially Degrade Water Quality***

The proposed program includes forecast-based operations, which would use more accurate long-term runoff forecasting to provide greater flexibility in reservoir operations. Proposed changes to reservoir operations under the proposed program include allowing flood releases to occur over a range of reservoir water surface elevations rather than requiring flood releases to start at a single, set water surface elevation, based on long-term forecast data. Under forecast based operations, water may be released from reservoirs in anticipation of higher than normal precipitation, to provide additional room for flood storage. When drier conditions are anticipated, more water may be retained to enhance water supply. In most years, this is anticipated to be beneficial because improving reservoir operations could actually increase the availability of water supply while also improving flood protection. However, DWR's current modeling has indicated that when the forecasts prove incorrect (particularly when an anticipated storm does not result in the expected precipitation), under some scenarios, the overall volume of water storage and releases available for water supply could potentially be reduced.

Therefore, changes in reservoir operations proposed under NTMAs could lead to altered temperature regimes. Changes in reservoir operations could also change the relative concentrations of constituents in various river reaches by releasing more or less water with constituent concentrations different than existing downstream conditions, potentially altering instream water chemistry or increasing loading of certain contaminants.

To alter reservoir operations, the project proponent would be required to comply with existing rules and regulations for water quality, such as TMDLs. Modifying reservoir operations could potentially improve water temperature and water quality beyond existing requirements by releasing colder water and providing pulse flows to support fish species. These changes would be beneficial. Because of the limited nature of reservoir operational changes in the NTMAs, and existing water quality rules and regulations that would continue to apply to reservoir operations, any adverse effects would likely be minor. This impact would be **less than significant**. No mitigation is required.

Impact SWQ-3 (NTMA): ***Alteration of Floodplain Inundation Patterns that Could Result in Substantial Erosion and Adversely Affect Water Quality***

NTMAs that would alter the frequency, areal extent, and duration of floodplain inundation may result in either increased or decreased availability and mobilization of sediments and associated contaminants. Setting back levees, purchasing floodplain easements, and changing reservoir operations could all have this effect. Inundating floodplain areas that are not inundated under current flow regimes and levee alignments may allow sediments and associated contaminants in these areas to be flushed into the river systems. This is especially likely to occur in agricultural areas. These contaminants may include pesticides, nutrients, metals, or coliform bacteria. Increasing the frequency, areal extent, and duration of floodplain inundation may also increase the bioavailability and transport of mercury, adversely impacting downstream water quality. Alternatively, inundation of floodplains may allow sediments and contaminants already suspended in the water to settle out of the water before returning to the river, thus improving downstream water quality. The likelihood of an adverse impact to water quality occurring is largely dependent on past land use history, and would be determined during subsequent site-specific studies. This impact would be **potentially significant**.

Mitigation Measure SWQ-3 (NTMA): ***Conduct and Comply with Phase I Environmental Site Assessments***

The project proponent will conduct a Phase I Environmental Site Assessment to determine the presence of any hazardous materials at all sites where new floodplain would be exposed to inundation. Project proponents of subsequent site-specific projects will implement all the recommended actions and measures identified in the Phase I Environmental Site Assessment. In addition, the project proponent will be required to comply with the federal and California endangered species acts and incorporate associated measures into the project design/planning features.

Implementing this measure would reduce Impact SWQ-3 (NTMA) to a **less-than-significant** level.

3.21.5 Environmental Impacts, Mitigation Measures, and Mitigation Strategies for LTMAs

This section describes the physical effects of LTMAs on water quality conditions. LTMAs include a continuation of activities described as part of NTMAs and all other actions included in the proposed program, and consist of all of the following types of activities:

- Widening floodways (through setback levees and/or purchase of easements)
- Constructing weirs and bypasses
- Constructing new levees
- Changing operation of existing reservoirs
- Achieving protection of urban areas from a flood event with 0.5 percent risk of occurrence
- Changing policies, guidance, standards, and institutional structures
- Implementing additional and ongoing conservation elements

Actions included in LTMAs are described in more detail in Section 2.4, “Proposed Management Activities.”

Impacts and mitigation measures identified above for NTMAs would also be applicable to many LTMAs and are identified below. The NTMA impact discussions and mitigation measures are modified or expanded where appropriate to address conditions unique to LTMAs. The same approach to future implementation of mitigation measures described above for NTMAs and the use of the term “project proponent” to identify the entity responsible for implementing mitigation measures also apply to LTMAs.

In addition, in some cases, LTMAs could have impacts and require mitigation measures not previously addressed in the discussion of NTMAs, and sufficient information is available for these LTMAs to use the same impact/mitigation discussion approach used for NTMAs. In these cases, additional impacts and mitigation measures specific to LTMAs are provided.

Impact SWQ-1 (LTMA): ***Temporary Construction-Related Effects on Water Quality that Would Not Cause Violations of Existing Water Quality Standards or Otherwise Substantially Degrade Water Quality***

This impact would be similar to Impact SWQ-1 (NTMA) because the same impact mechanisms would occur. Because LTMAs could occur throughout the study area and could be larger in scale than NTMAs, this impact is more likely to occur with implementation of LTMAs. In particular, expanding existing bypasses, or building new bypasses as proposed under LTMAs could have greater effects on water quality than modifying channels and structures under NTMAs. However, as described previously, construction activities associated with the proposed program are subject to construction-related stormwater permit requirements of the federal CWA's NPDES program. See also Impact HYD-1 (LTMA) and Mitigation Measure HYD-1 (LTMA) in Section 3.13, "Hydrology," for a discussion of the potential for changes in erosion or siltation to affect hydrology. Because construction activities would be subject to stormwater permit requirements, this impact would be **less than significant**. No mitigation is required.

Impact SWQ-2 (LTMA): ***Modification of Reservoir Operations that Would Not Cause Violations of Existing Water Quality Standards or Otherwise Substantially Degrade Water Quality***

This impact would be similar to Impact SWQ-2 (NTMA) because the same impact mechanisms would occur. Therefore, this impact would be **less than significant.** No mitigation is required.

Impact SWQ-3 (LTMA): ***Alteration of Floodplain Inundation Patterns that Could Result in Substantial Erosion and Adversely Affect Water Quality***

This impact would be similar to Impact SWQ-3 (NTMA) because the same impact mechanisms would occur. Because LTMAs could occur throughout the study area and could be larger in scale than NTMAs, this impact is more likely to occur with implementation of LTMAs.

Long-term conveyance actions, including operating new bypasses, expanding existing bypasses, and widening floodways would change floodplain inundation patterns in ways that could degrade or improve water quality. Inundating floodplain areas that are not inundated under current flow regimes and levee alignments may allow sediments and associated contaminants in these areas to be flushed into the river systems. This is especially likely to be the case in agricultural areas. These contaminants may include pesticides, nutrients, metals, or coliform bacteria. As mentioned above, increasing inundation of floodplains and tidal wetland areas has potential to increase loading of organic carbon and other disinfection byproduct precursors, adversely impacting municipal source waters in the Delta (State Water Project Contractors Authority 2007). Increasing the frequency, areal extent, and duration of floodplain inundation may also increase the bioavailability and transport of mercury, adversely impacting downstream water quality. Alternatively, inundation of floodplains may allow sediments and contaminants already suspended in the water to settle out of the water before returning to the river, thus improving downstream water quality. The likelihood of an adverse effect on water quality is largely dependent on past land use history, and would be determined during subsequent site-specific studies. Therefore, this impact would be **potentially significant**.

Mitigation Measure SWQ-3 (LTMA): ***Implement Mitigation Measure SWQ-3 (NTMA)***

Implementing this mitigation measure would reduce Impact SWQ-3 (LTMA) to a **less-than-significant** level.

LTMA Impact Discussions and Mitigation Strategies

Because of the more general and conceptual nature of many LTMAs, a great deal of uncertainty exists about how some LTMAs may be implemented and what environmental effects might result following their implementation. This uncertainty is to be expected for a broad, multiyear, and in some areas, conceptual program such as the CVFPP. Although these uncertainties exist, sufficient information exists to at least disclose additional potential impacts of LTMAs besides those discussed in the impact/mitigation pairings provided above. The following additional LTMA impacts are described in a broad narrative format; because of the uncertainty surrounding these impacts, no determination regarding their significance is provided. Consistent with Section 15145 of the CEQA Guidelines, these impacts are too speculative for evaluation beyond the narrative disclosure provided here.

Future project-specific CEQA evaluations for individual LTMAs will be used to determine the potential for the impacts described below to occur, determine their level of significance, and identify project-specific mitigation measures for significant impacts. Examples of potential mitigation strategies are provided after the following narrative impact discussions to disclose the nature and extent of mitigation actions that might be necessary to address these impacts.

For more information on this approach to evaluating LTMA impacts and providing mitigation strategies, see Section 3.1.2, "Analysis Methodology."

Impact discussions are divided among the geographic areas in the study area (i.e., Extended SPA, Sacramento and San Joaquin Valley watersheds, and SoCal/coastal CVP/SWP service areas). They are further subdivided according to the type of action (i.e., construction of conveyance facilities, facilities operations and maintenance from storage or conveyance actions, and other management actions).

LTMA Impact Discussion

Extended Systemwide Planning Area

Construction of Conveyance Facilities LTMAs include activities that could alter the quality of surface water in the Delta, particularly in its role as municipal source water, more substantially than NTMAs. These activities include constructing and operating new flood bypasses and other large-scale conveyance facilities, which could increase inundation of floodplains and tidal wetland areas. Water exported from the Delta service areas currently contains elevated concentrations of disinfection byproduct precursors such as dissolved organic carbon, and the presence of bromide increases the potential for formation of brominated compounds in treated drinking water. Increasing inundation of floodplains and tidal wetland areas has potential to increase loading of these compounds to the Delta, adversely impacting its beneficial use as municipal source water (State Water Project Contractors Authority 2006). However, the full extent of these actions is unknown; the potential effects on municipal source water quality are speculative at best.

Other Management Actions Impacts resulting from "other management actions" included in LTMAs are thoroughly described and evaluated above in the analysis of NTMAs and LTMAs. A general narrative description of additional impacts of LTMAs related to other management actions in the Extended SPA is not required.

Sacramento and San Joaquin Valley Watersheds

Construction of Conveyance Facilities Construction-related impacts of LTMAs that would affect surface water quality are thoroughly described and evaluated above in the analysis of NTMAs and LTMAs. A general narrative description of additional impacts of construction-related

LTMAs in the Sacramento and San Joaquin Valley watersheds is not required.

Facilities Operations and Maintenance from Conveyance Actions
None of the program's management actions related to conveyance would be implemented in the Sacramento and San Joaquin Valley watersheds. Therefore, no surface water quality impacts would result from conveyance-related management actions in this area.

Other Management Actions Impacts from "other management actions" included in LTMAs are thoroughly described and evaluated above in the analysis of NTMAs and LTMAs. A general narrative description of additional impacts of LTMAs related to other management actions in the Sacramento and San Joaquin Valley watersheds is not required.

SoCal/Coastal CVP/SWP Service Areas
None of the program's management actions would be implemented in the SoCal/coastal CVP/SWP service areas. Any changes to water deliveries in this region that might result from implementing proposed management actions would be minimal (see Section 3.13, "Hydrology"). Potential changes to the water quality of deliveries in this region are described above under "Extended SPA." A general narrative description of additional LTMA impacts related to other management actions in the SoCal/coastal CVP/SWP service areas is not required.

LTMA Mitigation Strategies The following mitigation strategies are examples of approaches that may be considered to address significant impacts via the mechanisms described above. These mitigation strategies may be considered, as applicable, during project-level evaluation of specific LTMAs. For more information on LTMA mitigation strategies, see Section 3.21.2, "Analysis Methodology."

Specific mitigation measures identified above in the NTMA and LTMA impact/mitigation pairings are not identified again in the mitigation strategies. It is assumed that mitigation measures described in the impact/mitigation pairings above would already be required, as applicable, as part of the project-level evaluation of specific LTMAs. Not all mitigation strategies will apply to all LTMAs; the applicability of mitigation strategies will vary based on the location, timing, and nature of each management action. In addition, some mitigation strategies on their own may not constitute sufficient mitigation under CEQA but must be coupled with other mitigation strategies to fully address the impacts of LTMAs.

- Evaluate activities that could result in elevated concentrations of disinfection byproduct precursors such as dissolved organic carbon close to municipal water intakes and adopt appropriate measures.