7. Surface Water Quality

7.1 Introduction

This chapter describes the existing surface water quality of reservoirs and rivers for the Extended, Secondary, and Primary study areas. Descriptions and maps of these three study areas are provided in Chapter 1 Introduction. Water quality can be affected by point and non-point discharges of contaminants, as well as physical and chemical changes within the water column caused by environmental and biological processes.

The regulatory setting for water quality is discussed briefly in this chapter, and is presented in greater detail in Chapter 4 Environmental Compliance and Permit Summary.

This chapter focuses primarily on the Primary and Secondary study areas. Potential impacts in the Extended Study Area were evaluated and discussed qualitatively. Potential local and regional impacts from constructing, operating, and maintaining the alternatives were described and compared to applicable significance thresholds. Mitigation measures are provided for identified significant or potentially significant impacts, where appropriate.

7.2 Affected Environment

7.2.1 Extended Study Area

Water quality in the Extended Study Area varies regionally due to differences in land use practices, geology, source water, and climate. Agricultural water quality issues include the urban development of agricultural land due to the increasing human population in the State. Agricultural return flows to natural waters also affect water quality in terms of various contaminants, including pesticides, increased water temperatures and depressed dissolved oxygen levels, increased salinity and nutrient loads, and sedimentation and groundwater overdraft due to reductions in surface water deliveries. These agricultural return flows contribute to wildlife refuge water supply. Municipal and industrial water quality is directly related to population levels. Increased urban development arising from increasing populations also increases the need for infrastructure to treat drinking water supplies as well as wastewater. Most large wastewater treatment plants are required to perform tertiary treatment before recycling wastewater for urban landscape irrigation, as a means to increase limited drinking water supplies. Urban stormwater discharges have been shown to have an impact to receiving waters through increased nutrient loads, pesticides, and trash.

For planning purposes, California is divided into 10 hydrologic regions corresponding to the State's major water drainage basins (DWR, 2005a). The CVP and SWP service areas of the Extended Study Area are located within nine of California's 10 hydrologic regions. San Luis Reservoir is located within the San Joaquin River Hydrologic Region. The nine hydrologic regions are described below:

- **North Coast:** Klamath River and Lost River basins, and all basins draining into the Pacific Ocean from Oregon south through the Russian River Basin.
- **San Francisco Bay:** Basins draining into San Francisco, San Pablo, and Suisun bays, and into the Sacramento River downstream from Collinsville; western Contra Costa County; and basins directly

tributary to the Pacific Ocean downstream from the Russian River watershed to the southern boundary of the Pescadero Creek Basin.

- **Central Coast:** Basins draining into the Pacific Ocean downstream from the Pescadero Creek watershed to the southeastern boundary of Rincon Creek Basin in western Ventura County.
- **South Coast:** Basins draining into the Pacific Ocean from the southeastern boundary of Rincon Creek Basin to the international border with Mexico.
- **Sacramento River:** Basins draining into the Sacramento River system in the Central Valley (including the Pit River drainage), from the Oregon border south through the American River drainage basin.
- **San Joaquin River:** Basins draining into the San Joaquin River system, from the Cosumnes River basin on the north through the southern boundary of the San Joaquin River watershed.
- **Tulare Lake:** The closed drainage basin at the south end of the San Joaquin Valley, south of the San Joaquin River watershed, encompassing basins draining to Kern Lakebed, Tulare Lakebed, and Buena Vista Lakebed.
- **South Lahontan:** The interior drainage basins east of the Sierra Nevada crest, south of the Walker River watershed, northeast of the Transverse Ranges, and north of the Colorado River Region. The main basins are the Owens and the Mojave River basins.
- **Colorado River:** Basins south and east of the South Coast and South Lahontan regions; areas that drain into the Colorado River, Salton Sea, and other closed basins north of the border with Mexico.

The following discussions summarize surface water quality conditions for these hydrologic regions, and describe their relationships with the other hydrologic regions.

7.2.1.1 *North Coast Hydrologic Region*

The North Coast Hydrologic Region faces many water quality and water supply challenges. The North Coast Regional Water Quality Control Board's (North Coast RWQCB) water quality priorities highlight the need for control of nonpoint source runoff from logging, rural roads, agriculture, and urban areas (DWR, 2005b). Sediment, temperature, and nutrients are the primary focus of the RWQCB's 303(d) list of impaired water bodies. Along the coast, nonpoint-source pollution can cause microbial contamination of shellfish growing areas, especially oysters. Much of the region is characterized by rugged, steep, forested lands, with highly erodible, loosely consolidated soils; these conditions, combined with wildfires, extensive timber harvesting, and heavy precipitation primarily in the form of rain, make the watershed highly susceptible to erosion and landslides. Heavy runoff, in turn, causes stream sedimentation that adversely impacts habitat for spawning and rearing anadromous fish. Channel modifications and water diversions have radically changed water quality conditions in many waterbodies in the region by reducing natural flows that dilute contaminant concentrations and lessen their impacts. In the southern portion of the region, the development of new hillside vineyards is an increasing source of erosion and pesticides.

Fisheries can be adversely affected by a number of factors related to both water quality and water quantity. The Eel, Mad, Trinity, Klamath and Russian rivers, as well as many other streams, suffer from sedimentation, which can smother salmonid spawning areas. The *Water Quality Control Plan for the North Coast Region* (North Coast Basin Plan) sets turbidity (a measure of water clarity) restrictions to control erosion impacts from logging and related activities, such as road building (NCRWQCB, 2011).

Timber harvests can also decrease the canopy shading rivers and streams, thereby increasing water temperatures to levels that are detrimental to cold water fisheries.

The North Coast Basin Plan specifically establishes temperature objectives for the Trinity River, in which reduced flows have disrupted temperature and physical cues for anadromous fish runs. Because of water diversions, summer temperatures in the Trinity River as well as the Klamath River can be lethal to salmonids. Fisheries can be further affected by the lack of woody debris for pool habitat and sediment metering.

The North Coast Basin Plan requires tertiary, or three-phase, treatment of wastewater discharges to the Russian River, which is a major source of domestic water, and establishes limits on bacteriological contamination of shellfish-growing areas along the coast. The plan also prohibits or strictly limits waste discharges to the Klamath, Trinity, Smith, Mad, and Eel rivers, as well as estuaries and other coastal waters. Nonpoint source runoff, especially after heavy precipitation, has resulted in contamination and closure of shellfish harvesting beds in Humboldt Bay.

Other water quality concerns include the impacts of boating fuel constituents, such as methyl tertiary-butyl ether (MTBE) to recreational water use at Trinity, Lewiston, and Ruth lakes. Abandoned mines, forest herbicide application, and historical discharge of wood treatment chemicals at lumber mills, including from the Trinity River Lumber Company in Weaverville, also are regional issues of concern.

Relationship with Other Regions

The Klamath River Basin straddles the Oregon border, such that water from the upper basin flows into Oregon and eventually returns to California upstream from Iron Gate Reservoir. On the Oregon side of this interstate basin, two surface water diversions export an average of 29,600 acre-feet per year from Klamath River tributaries into the Rogue River system in Oregon. The Klamath River Basin also receives a small amount of imported water (approximately 2,000 acre-feet per year) from the upper reaches of the Sacramento River Hydrologic Region through a canal (the North Fork Ditch).

The North Coast Hydrologic Region exports a large volume of water from the upper reaches of the Trinity River into the Sacramento River Region through Reclamation's Lewiston Dam and the Clear Creek Tunnel. For 1998, 2000, and 2001, the Trinity River exports were 851,000 acre-feet per year, 1.11 million acre-feet per year, and 669,000 acre-feet per year, respectively (DWR, 2005b). In future years, these Trinity River exports are likely to be reduced due to the increased instream flows established for the Trinity River fishery.

7.2.1.2 *San Francisco Bay Hydrologic Region*

The San Francisco Bay Hydrologic Region is centered on the San Francisco Bay/Delta Estuary and its water quality (DWR, 2005c). The estuary's immediate watershed is highly urbanized, resulting in contaminant loads from point and nonpoint sources, as well as pollutants from the Napa, Petaluma, and Guadalupe rivers, the Sacramento-San Joaquin Delta, and the Central Valley. San Francisco Bay Area residents generally receive good quality drinking water that varies by source and treatment. Sources range from the Hetch Hetchy Reservoir and Mokelumne River, to local surface and groundwater and variable quality Delta water. Utilities that depend on the Delta for all or part of their domestic water supplies meet the current drinking water standards, although they remain concerned about issues, such as microbial contamination, salinity, and organic carbon.

Water and sediment in the estuary meet quality guidelines for most contaminants, with constituents in water meeting toxicity and chemical guidelines approximately 87 percent of the time. Sediment concentrations are more problematic due to legacy pollutants[1], with only approximately 60 percent of the sediment samples meeting chemical guidelines and passing toxicity tests. Estuary water quality has significantly improved since these chemicals have been prohibited, with fewer toxic episodes and decreased silver concentrations in the South Bay. Implementation of secondary, or two-phase, treatment of domestic wastewater has dramatically improved the quality of the San Francisco Estuary, especially the oxygen content, as has the reduction in the use of organophosphate pesticides.

Major water quality issues include control of stormwater, urban, and construction site runoff, as well as runoff and discharges from the vast Central Valley and Delta watershed. Legacy pollutants, such as PCBs and mercury, contaminate fish in the estuary. Other water quality concerns include copper and nickel in the South Bay, selenium from Contra Costa refineries, erosion from vineyards in Napa and Sonoma valleys, pesticides in urban creeks, and toxicity of water and sediment. Exotic and invasive species, such as the Chinese mitten crab and Asian clam, threaten to undermine the estuary’s planktonic food web base, thus potentially altering its ecosystem (including native species). Because San Francisco Bay has several active seaports, discharge of ballast water and vessel wastes and maintenance dredging and disposal of contaminated sediments are water quality concerns. New contaminants are emerging that may be causing impacts to the aquatic ecosystem, including polybrominated diphenyl ethers (PBDEs), pyrethroid insecticides, and compounds from pharmaceuticals and personal care products.

The bay acts as a sediment repository, so persistent sediment-bound contaminants, such as mercury, dioxins, PCBs, and organochlorine pesticides have accumulated over time. These compounds also bioaccumulate[2] in the food chain, causing contamination of bay fish and endangering their consumers, including humans and wildlife. New inputs of the persistent sediment contaminants in the estuary are now controlled because the use of most organochlorine pesticides and PCBs are banned, and the concentrations in the sediments and in organisms appear to be declining. The San Francisco RWQCB is developing new regulatory requirements to address the mercury sources to the estuary, including the New Almaden mine, located in the vicinity of San Jose, and thousands of other abandoned mercury and gold mine tailings in the Central Valley watershed. Mercury contamination in estuary fish, such as the striped bass, has remained high for more than 30 years. Wetland restoration could increase mercury methylation[3] processes and cause higher contamination in fish. State and federal agencies, working through the CALFED Bay Delta Program and other organizations, have funded several studies to determine potential effects of restoration and explore management actions that would decrease methylmercury[4] production and bioaccumulation.

Relationship with Other Regions

The combined flows of the Sacramento and San Joaquin river watersheds flow through the Delta and into the San Francisco Bay. Delta outflow interacts with tides to determine how far salt water intrudes from the

[1] Legacy pollutants, which include certain heavy metals, dichloro-diphenyl-trichloroethane (DDT), and polychlorinated biphenyls (PCBs), are persistent organic pollutants that are now banned, but were used in the past and persist in the environment long after they were first introduced.

[2] The gradual build-up of toxins in an organism at levels higher than those that occur in the surrounding environment.

[3] The conversion of inorganic mercury by microorganisms in soil and sediments (in air or water) to organic methylmercury.

[4] An organic form of mercury. It is a neurotoxin that is especially dangerous to fetuses and infants, attacking the central nervous system and causing an array of developmental and other problems. Methylmercury contamination and exposure can also adversely affect reproductive success and health of fish and other species.

ocean into the San Francisco Bay Estuary. The resulting salinity gradients influence the distribution of many estuarine fishes and invertebrates as well as plants, birds, and animals in wetlands areas. Delta outflow varies with hydrology, reservoir releases, and diversions upstream. Some surface water supplies that originate in the San Joaquin Hydrologic Region are diverted across the valley to the San Francisco Bay Hydrologic Region via the Mokelumne Aqueduct, which is operated by the East Bay Municipal Utility District. Surface water is also diverted through the Hetch Hetchy Aqueduct, which is owned and operated by the City of San Francisco. The average annual diversions made by these two projects from the Mokelumne and Tuolumne rivers are approximately 245,000 acre-feet per year through the Mokelumne Aqueduct, and 267,000 acre-feet per year through the Hetch-Hetchy Aqueduct (DWR, 2005c).

7.2.1.3 *Central Coast Hydrologic Region*

The Central Coast's limited surface water supply and few large surface water storage facilities, combined with the growing demand for water, is resulting in more dependence on groundwater (DWR, 2005d). Unique coastal resources, such as Morro Bay and Monterey Bay, as well as the Salinas Valley, are the focus of water quality issues. Sedimentation poses the greatest water quality threat to Morro Bay, one of 28 estuaries in the National Estuary Program. The bay is also contaminated by pathogens from agriculture, boats, and urban runoff; nutrients from fertilizers, animal wastes, and urban runoff; heavy metals from abandoned mines in the upper watershed; and sediment from offshore boatyards. Elevated levels of bacteria have closed many of the shellfish-growing beds in Morro Bay, and have occasionally closed beaches in Santa Cruz County and southern Santa Barbara County. To protect special areas of biological significance, waste discharges are prohibited or limited in portions of Monterey Bay, a National Marine Sanctuary, and other specific coastal and ocean waters of the region. In its 2005 Triennial Review, the Central Coast RWQCB also identified the need to incorporate new microbiological standards for water-contact recreation in this region.

The Salinas River watershed has significant nitrate contamination related to agriculture, which is the valley's main land use. The nearby Pajaro River watershed faces a variety of water quality threats, such as erosion (primarily from agricultural practices), urban runoff, sand and gravel mining, flood control projects, off-road vehicles, and historical mercury mining in the Hernandez Lake area.

<u>Relationship with Other Regions</u>

Historically, the communities of the Central Coast Hydrologic Region have relied on local surface water and groundwater supplies to meet their needs. The northern part of the region first received imported water with completion of the San Felipe Unit of the CVP in 1987. This facility delivers water to San Benito County users primarily for agricultural purposes from San Luis Reservoir in the San Joaquin River Hydrologic Region. Ten years later, the Coastal Branch of the SWP was completed to import water to San Luis Obispo and Santa Barbara counties from the California Aqueduct in the Tulare Lake Hydrologic Region. There are no other water imports into the Central Coast region. Because there is seldom any excess surface water in this region's watersheds, there are no water exports from this region to other parts of the State.

7.2.1.4 *South Coast Hydrologic Region*

Similar to many regions in the State, water quality and water supply challenges are intertwined. The South Coast region must manage for uncertainties caused by population and economic growth (DWR, 2005e). Growth will not only affect demand, but it will add contamination challenges from increases in wastewater discharges and urban runoff, as well as increased demand for water-based recreation. Outside of the region, environmental and water quality needs in the Delta and Owens River/Mono Basin systems affect imported water supply reliability and quality. The region must also assess and plan for impacts of climate variations and global climate change, as well as the cost of replacing aging infrastructure.

Given the size of the region and the diverse sources of water supply, the challenges to the region's water quality are varied. Surface water quality issues in the South Coast are dominated by stormwater and urban runoff, which contribute contaminants (including trash) to local creeks and rivers. These pollutant sources, as well as sanitary sewer overflows, ocean outfalls, tidal input, and even wildlife, can degrade coastal water quality, closing beaches and increasing the health risks from swimming. These sources also specifically affect water quality in the major bays: Santa Monica, Newport, and San Diego. Newport Bay, for instance, suffers from algal blooms (due to excess nutrients), toxicity to aquatic life, high bacterial counts, and sedimentation. Shipping can also influence water quality, especially at the U.S. Navy base in San Diego Bay and the Long Beach and Los Angeles harbors, where there are toxic sediment hot spots. Harbors, marinas, and recreational boating threaten water quality via ballast water discharges, which can introduce petroleum and sewage discharges and spills, biocides from boat hulls, boat cleaning and fish wastes, trash, and reduced water circulation. Constructed wetland projects in Hemet/San Jacinto, San Diego Creek, and Prado Basin remove large loads of nitrogen from wastewater and urban runoff. Salinity, nitrogen, and microbes are the major contaminants in the Santa Ana River, affecting downstream beneficial uses such as swimming and groundwater recharge for domestic use. Because of upstream irrigation diversions, flows in the middle and lower Santa Ana River are composed mostly of recycled water, creating a year-round flow that is high in salinity.

Lake Elsinore, the largest natural freshwater lake in southern California, experiences nuisance algae blooms from excess nutrients, impairing its ecological and recreational beneficial uses. Local groups have implemented many wetland and river restoration projects to improve water quality, including at Bolsa Chica, in Ballona Creek, and along the Los Angeles and San Gabriel rivers. The United States and Mexico jointly built the International Wastewater Treatment Plant to treat a portion of the sewage from Tijuana, which flows across the international boundary into the San Diego Basin.

The Chino Basin hosts the highest concentration of dairy animals in the U.S. In a 40-square-mile area, over 300,000 animals are maintained on approximately 300 dairies (DWR, 2005e). Because of a lack of sufficient land for manure disposal, as well as flooding from expanding suburban development, dairy runoff contributes nitrate, salts, and microorganisms to groundwater as well as surface water. Since 1972, the Santa Ana RWQCB has issued waste discharge requirements to the dairies in this basin. In addition, pilot projects to develop sewer systems for dairies and for treating dairy wash water have also recently been completed.

Public health and environmental and economic concerns have grown with the expansion of water recycling programs in the South Coast region. Some concerns are related to the total dissolved solids (TDS) content of wastewater and the presence in treated wastewater of pharmaceuticals, household products, and other emerging contaminants. The high salinity of imported Colorado River water limits the number of times water can be reused before the salt content becomes too high, and wastewater can only be discharged to the ocean. Increased use of recycled water and marginal quality groundwater supplies during droughts can result in water quality problems for some local supplies that endanger future water management projects. For instance, groundwater recharge potential may be restricted because the RWQCB has established TDS requirements for recharge water in some groundwater basins to protect existing basin water quality.

The average TDS concentration of the Mohave Water District's Colorado River Aqueduct water is approximately 600 to 700 mg/L, and the average TDS content of SWP water supply is approximately 300 mg/L. The water supply from the Los Angeles Aqueduct has a significantly lower TDS concentration, typically approximately 160 mg/L (DWR, 2005e).

In addition to salinity, several established and emerging contaminants of concern to the region's drinking water supplies include disinfection byproducts (DBPs), perchlorate, arsenic, nitrosodimethylamine (NDMA), hexavalent chromium, and MTBE. Imported water from the Owens Valley is of excellent water quality, and imported Delta water quality is generally good. Nonetheless, arsenic is a concern in the Owens Valley supply, and Delta water can contain precursors (such as organic carbon and bromide) of potentially carcinogenic DBPs, if treated with certain disinfection processes necessary to inactivate pathogens in drinking water.

Relationship with Other Regions

The South Coast Hydrologic Region imports water from three primary regions including SWP deliveries from the Sacramento River and San Joaquin River hydrologic regions; Owens Valley Aqueduct deliveries from the South Lahontan Hydrologic Region; and deliveries from the Colorado River Hydrologic Region.

7.2.1.5 *Sacramento River Hydrologic Region*

Surface water quality in the Sacramento River watershed is relatively good, when compared with statewide data, making the Sacramento River one of the most desirable water sources in the State (DWR, 2005f).

Nonetheless, increased turbidity, rice pesticides, and organophosphate pesticides, such as diazinon, affect fisheries and drinking water supplies. The decline of fisheries in the Sacramento River is, in part, related to water quality problems on the river's mainstem. Those water quality problems include unsuitable water temperature, toxic heavy metals, such as mercury, copper, zinc, and cadmium from acid mine drainage; and pesticides and fertilizer in agricultural runoff. Holding of rice field drainage, which allows for degradation of rice herbicides by re-flooding after harvest, has effectively addressed this water quality concern among downstream water users. In the Cache Creek watershed, Clear Lake suffers from large mercury, sediment, and nutrient loadings, the latter leading to nuisance algal blooms. Along with a few select other waterbodies, the *Water Quality Control Plan for the Sacramento River and San Joaquin River Basins* (Central Valley Basin Plan) (CVRWQCB, 2011) specifically prohibits direct discharges of wastes into Folsom Lake and the lower American River downstream to its confluence with the Sacramento River; waste discharges from houseboats on Shasta, Clear Lake, and in the Delta are also banned. High density recreation use of Whiskeytown and Shasta lakes may be contributing to high bacteria levels in these two reservoirs.

An evaluation of the strength of relationships between human activity (as indicated by landcover) and pollutant concentrations in recently deposited (2008) stream sediment indicates that the majority of sample sites in the Sacramento River watershed are in the lowest quartile for the range of concentrations for the metals cadmium, copper, lead, and zinc, with sites near Redding and Woodland in the second quartile (SWRCB, 2012a). These second quartile site results are related to the major point sources for metals discharging from Iron Mountain Mine (Redding area) and Cache Creek (Woodland area). Quartile cutoffs are at 25 percent, 50 percent, and 75 percent of the maximum measured concentrations.

Adverse effects from these constituents on sediment-dwelling organisms are not expected to occur below a threshold effects concentration (TEC), while adverse effects are expected to occur frequently above a probable effects concentration (PEC) (MacDonald et al. 2000, as cited in SWRCB, 2008). At concentrations between a TEC and PEC, it is difficult to predict whether or not the sediments would be toxic to organisms. Total mercury in unsieved sediment samples were found to be below the threshold effects concentration (TEC) for the majority of sample sites in the watershed, with sites near Redding and Woodland falling between the TEC and PEC.

For the legacy pollutant PCB, results were below the laboratory detection limit for all but one site, which was below the TEC. Results for total DDT, another legacy pollutant, were mostly below the TEC, with two sites between the TEC and PEC (SWRCB, 2012a).

Pyrethroid pesticides were either ‘non-detect’ or in the lowest quartile in the watershed. The higher pyrethroid levels were associated with the larger urban areas within the watershed (SWRCB, 2012a).

Sediment toxicity observed in the watershed was determined to be not significantly toxic, with the exception of the sample site in the Redding area and the associated Iron Mountain Mine acid mine drainage (SWRCB, 2012a).

Mercury contamination is significant throughout the State. In its 2005 Triennial Review, the Central Valley RWQCB identified mercury loads, a legacy of California’s gold mining heritage, as one of the most significant water quality problems in the region (SWRCB, 2012a). The Sacramento River watershed is the major source of total mercury to the Delta, contributing approximately 90 percent of the total mercury loads (SRWP, 2004). In particular, the Cache Creek watershed is the major source of mercury to the Delta; to a lesser extent, mercury is also a concern in Lake Berryessa and Marsh Creek Reservoir. Major sources of total mercury loads to the Sacramento River watershed include runoff and erosion from historic gold mining sites, erosion of native soils, and natural mineral springs. Minor mercury sources include treated wastewater, urban runoff, historic mercury mines, and atmospheric mercury deposition from external sources (SRWP, 2004). Because of methylmercury’s bioaccumulative properties, several waterbodies in the Sacramento River region have fish consumption advisories. Pesticide management and agricultural water discharge have received increased attention by the Central Valley RWQCB, which made the decision to eliminate waivers associated with agricultural discharge in 2003. Coalitions in the region are forming partnerships to address this issue through a watershed approach, as provided for by the Central Valley RWQCB and affirmed by the State Water Resources Control Board in its 2005 review of the Irrigated Lands Conditional Waiver. Stakeholders in the region are working to find a solution that encompasses the protection of public health, meets current and future water quality regulations, and allows for a sustainable agricultural economy.

Relationship with Other Regions

The Sacramento River Hydrologic Region provides the majority of streamflow to the San Francisco Bay Hydrologic Region and is also the major contributor of fresh water to the CVP and SWP delivery systems, which supply portions of the water needs of the following hydrologic regions: San Joaquin River, Central Coast, South Coast, and Tulare Lake.

7.2.1.6 *San Joaquin River Hydrologic Region*

Historically, the surface water originating from Sierra Nevada rivers has proven to be a dependable supply of water, but it meets only half of the region’s total water requirements (DWR, 2005g). Water quality in this Region generally meets the standards for beneficial uses identified in the Central Valley Basin Plan. Imported surface water and groundwater pumping make up the difference. Because the region relies on imported surface water from other regions, there is growing concern over the long-term availability of external supplies.

The major water quality problems of the San Joaquin River Hydrologic Region are a result of many factors, including depleted freshwater flows. The San Joaquin River Restoration Program was formed in response to a 2006 settlement of an 18-year-old lawsuit between the U.S. Departments of the Interior and Commerce, the Natural Resources Defense Council, and the Friant Water Users Authority (SJRRP, 2010). The Settlement is based on two goals: the first goal is to restore flows to the San Joaquin River from Friant Dam to the confluence of the Merced River while reducing or avoiding adverse water supply impacts from restoration flows. The second goal is to restore and maintain fish populations in “good condition” in the mainstem of the San Joaquin River downstream from Friant Dam to the confluence of the Merced River, including naturally-reproducing and self-sustaining populations of salmon and other fish. Restoring flows to the San Joaquin River to meet these goals includes improving water quality conditions in the restoration reaches for the benefit of fish, wildlife, and other beneficial uses, including agricultural and municipal supply.

Other major water quality problems in the San Joaquin River Hydrologic Region include municipal and industrial wastewater discharges, salt loads from agricultural drainage and runoff, and other pollutants associated with long-term agricultural irrigation and production, including nutrients, selenium, boron, and organophosphate pesticides. The entire Central Valley, which includes the San Joaquin River, Sacramento River, and Tulare Lake basins, has 40 waterbodies that are impaired due to agricultural drainage and runoff, including 800 miles of waterways, and 40,000 acres of the Delta. In its 2005 Triennial Review of its basin plan, the Central Valley RWQCB identified high priority problems as salinity and boron discharges to the San Joaquin River, low dissolved oxygen problems in the lower San Joaquin River, control of organophosphorous pesticides, and the need for stronger policies to protect Delta drinking water quality.

High salinity is a problem in the San Joaquin River basin because of the greatly altered flows of the river, most of which is diverted from its natural course at Friant Dam. In addition, imported irrigation water from State and federal projects annually transport more than a half million tons of salts into the west side of the San Joaquin River region. Water released from New Melones Reservoir on the Stanislaus River is used to help meet the salinity and dissolved oxygen requirements at Vernalis on the lower San Joaquin River. Agricultural drainage and discharges from managed wetlands are already regulated in the 370,000-acre Grasslands watershed, which contributes high levels of salts, selenium, boron, and nutrients to Mud and Salt sloughs. These sloughs are some of the primary contributors of selenium to the San Joaquin River. Dairies, stockyards, and poultry ranches are also a concern in the region because they generate waste products including pathogens, nutrients, salts, and emerging contaminants[5] of concern that enter the waterways. Some dairies and other agricultural operations are already subject to regulatory review. Water releases from managed wetlands, a part of the State and federal wildlife refuge system, also

[5] Emerging contaminants are hazardous materials or mixtures (naturally occurring or humanmade chemical, microbial, or radiological substances) that are characterized by having: (1) a perceived or real threat to human health, public safety, or the environment; (2) no published health standards or guidelines; (3) insufficient or limited available toxicological information or toxicity information that is evolving or being re-evaluated; or (4) significant new source, pathway, or detection limit information.

can discharge salts and nutrients. The erosion of westside streams is the primary source of organochlorine pesticides in the San Joaquin River.

Migrating and spawning salmonids face high temperatures in the Stanislaus, Tuolumne, and Merced rivers downstream from dams during certain times of the year, depending on hydrologic and water supply conditions. Contamination of fish is also a concern in these three rivers, as well as in the mainstem of the San Joaquin River. For example, the Central Valley RWQCB cites one study that found a 43-mile reach of the San Joaquin River (between the confluences with the Merced and the Stanislaus rivers) to be toxic to fish approximately half the time. In the lower San Joaquin River, low dissolved oxygen levels in the Stockton Deepwater Ship Channel are attributable to warm temperatures, low flows, nutrients, and channel configuration. This portion of the river with low dissolved oxygen is potentially a barrier to fall-run Chinook salmon migrating upstream to the Merced, Tuolumne, and Stanislaus rivers to spawn.

In relation to other geographic regions of the State, water discharges from irrigated lands have their greatest impact to water quality in the Central Valley, which covers 40 percent of California's land area and contains seven million irrigated acres and more than 25,000 individual agricultural dischargers.

Although existing agricultural land use practices affect water quality now, the expanding urbanization of Central Valley cities will generate new and different water quality problems in the future. Since the late 1970s, landscape irrigation with recycled water is an increasingly used strategy to reduce potable water demand and reduces the volume of water wasted after a single use (SWRCB, 1977). The SWRCB prescribes general waste discharge permits for municipal wastewater discharge systems to construct and operate more costly tertiary wastewater treatment facilities to use recycled water and prevent water quality impacts to current and possible future beneficial uses (SWRCB, 2009).

Relationship with Other Regions

The San Joaquin River Hydrologic Region depends on receiving surface water from other regions of the State to meet a portion of its developed agricultural and urban water uses. For many years, the region has received imported CVP water from the Sacramento-San Joaquin Delta via the Delta Mendota Canal, and from CVP Friant Dam on the upper San Joaquin River. This region also receives some SWP water from the California Aqueduct.

Some surface water supplies that originate in the San Joaquin Hydrologic Region are also diverted across the valley to the San Francisco Bay Hydrologic Region via the Mokelumne Aqueduct and the Hetch Hetchy Aqueduct. The average annual diversions made by these two projects from the Mokelumne and Tuolumne rivers are approximately 245,000 acre-feet per year through the Mokelumne Aqueduct, and 267,000 acre-feet per year through the Hetch-Hetchy Aqueduct (DWR, 2005g).

7.2.1.7 *Tulare Lake Hydrologic Region*

The Tulare Lake Hydrologic Region is in the southern end of the San Joaquin Valley. This region includes all of Tulare and Kings counties and large portions of Fresno and Kern counties.

Agricultural runoff and drainage are the main sources of nitrate, pesticides, and selenium that endanger groundwater and surface water beneficial uses (DWR, 2005h). In locations where groundwater quality is marginal to unusable for agriculture, farmers use good quality surface water to irrigate crops or blend higher quality surface water with poor quality groundwater to create a larger supply. The basin also has a relatively large concentration of dairies that contribute microbes, salinity, and nutrients to both surface water and groundwater. In addition, oilfield waste has impacted water quality. According to the Central

Valley Basin Plan, there are more than 800 oilfield waste dischargers, of which 250 are regulated pursuant to waste discharge requirements.

The quality of local surface water from the Kings River and the San Joaquin River (diverted south through the Friant-Kern Canal) is generally considered excellent for irrigation, municipal, and industrial uses. However, the Central Valley RWQCB specifically identified salinity in the lower Kings River as a water quality priority in its 2007 Triennial Review. On the west side of the region, DWR has sought solutions to the flooding on the Arroyo Pasajero, which threatens the California Aqueduct. The aqueduct, which forms a barrier to arroyo floodwaters and sediment flow, is at risk of failure during major rainstorms in the watershed. Also, the naturally occurring asbestos in the arroyo sediments that enter the aqueduct during floods has raised questions of possible health risks. Both Panoche and Silver creeks contribute large sediment loads to the valley floor, and Panoche Creek also contains elevated levels of selenium.

In addition, drainage water is sometimes contaminated with naturally occurring, but elevated, levels of selenium, boron, and other toxic trace elements that threaten the water quality, environment, and fish and wildlife. Water planners had originally envisioned a master surface water drain to remove this poor quality water, but that proposal was never implemented. Reclamation has an obligation to provide agricultural drainage service to farm lands served by the CVP on the west side of the valley. To convey this sometimes contaminated drainwater more directly to the San Joaquin River and away from the sensitive San Luis National Wildlife Refuge Complex, a portion of the San Luis Drain was reopened in September 1996 as part of the Grassland Bypass Project. The San Luis Drain was modified to allow drainage through six miles of Mud Slough, a natural waterway that passes through the San Luis National Wildlife Refuge Complex and a section of the North Grassland Wildlife Area.

San Joaquin Valley agricultural drainage water quality monitoring began in 1959 as a cooperative agreement between DWR and the University of California. In 1984, the San Joaquin Valley Drainage Program was established as a joint federal and State effort to investigate drainage and drainage-related problems and identify possible solutions. In September 1990, the San Joaquin Valley Drainage Program summarized its findings and presented a plan to manage drainage problems in a report titled “A Management Plan for Agricultural Subsurface Drainage and Related Problems in the Westside San Joaquin Valley.”

Relationship with Other Regions

The Tulare Lake Hydrologic Region receives CVP water from the San Joaquin River region via the Friant-Kern Canal and imported water from the Sacramento-San Joaquin Delta via the California Aqueduct and the San Luis and Delta-Mendota canals. The economic health of the region depends heavily on the availability of imported surface water to meet current and future needs.

7.2.1.8 *South Lahontan Hydrologic Region*

The quality of the limited surface water resources is excellent in the South Lahonton Hydrologic Region, and is influenced greatly by snowmelt from the eastern Sierra Nevada (DWR, 2005i). However, at lower elevations, groundwater and surface water quality can be degraded, both naturally from geothermal activity, and as a result of recreational uses and cattle grazing. Nutrients entering Crowley Reservoir, on the Owens River south of Mono Lake, have contributed to low dissolved oxygen levels in the reservoir. Water quality and quantity are inherently related in the Owens River watershed because of the large exports of surface and groundwater to the City of Los Angeles. Arsenic, a known human carcinogen, is a health concern in the basin, and therefore, in Los Angeles as well, especially with the recently proposed lower drinking water standard for this chemical. In its 2003 Triennial Review, the Lahontan RWQCB identified the need for site-specific ammonia objectives for Paiute Ponds and Amargosa Creek in Los Angeles County (LRWQCB, 2007). The monitoring and cleanup of chromium in groundwater and the cleanup of sites contaminated by mining wastes are additional water quality needs for this region.

Relationship with Other Regions

Although most of Mojave Water Agency's (MWA) service area is in the South Lahontan Hydrologic Region, a portion of its service area extends into the Colorado River Hydrologic Region (Lucerne and Johnson valleys and the Morongo Basin). The service area includes the community of Yucca Valley, which has an allocation for up to 7,200 acre-feet of MWA's surface water from the SWP. Imported SWP water is used to recharge groundwater supplies in the Mojave River Valley basins. Some of these surface water and groundwater supplies are also exported from the Owens and Mono portions of the South Lahontan Hydrologic Region to the South Coast Hydrologic Region by the Los Angeles Department of Water and Power via the Los Angeles Aqueduct.

7.2.1.9 *Colorado River Hydrologic Region*

The Salton Sea, with its increasing salinity, selenium contamination, and nutrient enrichment (i.e., eutrophication), is the primary focus of water quality issues within the Colorado River Hydrologic Region (DWR, 2005j). The largest sources of surface water inflow to the sea are the New and Alamo rivers and the Imperial Valley agriculture drains, all of which contribute pesticides, nutrients, selenium, and silt. The New River has been described as the most polluted river in the United States. Originating in Mexicali, Mexico, the New River flows across the border, through the City of Calexico, and continues north, where it empties into the Salton Sea. It conveys urban runoff, untreated and partially treated municipal and industrial wastes from the Mexicali Valley, and agricultural runoff from the Mexicali and Imperial valleys. These pollution sources contribute pesticides, pathogens, silt, nutrients, trash, and volatile organic compounds (the latter, primarily from Mexican industry) to the Salton Sea. The Alamo River, which originates two miles south of the border and also flows north to the Salton Sea, consists mainly of agricultural drainage from the Imperial Valley. The Coachella Valley Stormwater Channel, which also drains to the Salton Sea, is heavily contaminated at its north end with pathogens from municipal wastewater plants in the Coachella Valley and agricultural drainage.

A multiagency group, The Citizen's Congressional Task Force on the New River, was created in 1997. Its mission is to improve agricultural drain water quality that flows into the New River and, ultimately, to the Salton Sea. Participating agencies include the Imperial Irrigation District, Desert Wildlife Unlimited, County of Imperial, Reclamation, U.S. Geological Survey, USFS, DFG, California RWQCB, U.S. Environmental Protection Agency (USEPA), Ducks Unlimited, and U.C. Riverside. In 2000, the Task Force constructed two pilot wetland projects (a seven-acre site near Brawley and a 68-acre site near Imperial) to test the effectiveness of constructed wetlands in lowering non-point source pollutants. Due to the success of the pilot sites, up to 30 additional wetland sites are proposed on both the New and Alamo rivers.

Contamination in the Salton Sea presents threats to migrating birds on the Pacific Flyway. At certain times of the year, nutrient loading to the Salton Sea supports large algal blooms that contribute to odors, as well as low dissolved oxygen levels, which adversely affect fisheries. Selenium is a more recent constituent of concern, and has the potential to adversely affect fish and wildlife.

The relatively saline Colorado River provides irrigation and domestic water to much of southern California. USEPA first discovered low levels of perchlorate in the Lower Colorado River in 1997 from a Kerr-McGee chemical facility in the Las Vegas Wash, the nation's largest perchlorate contamination site. Cleanup of this site commenced in 2002 and has reduced perchlorate levels in the wash by 70 percent within the first two years (USEPA, 2004). Septic systems at recreational areas along the river are also a concern for domestic and recreational water uses.

Relationship with Other Regions

The Coachella Valley Water District and Desert Water Authority receive their annual allocations of SWP water through an exchange agreement with Metropolitan Water District of Southern California (MWD), the South Coast Hydrologic Region's largest water wholesale agency. These districts are also participants in another agreement that delivers and stores water from the Colorado River into the Coachella Valley's largest groundwater basin during periods of high flows.

7.2.2 Secondary Study Area

7.2.2.1 *Overview*

The water quality of the Sacramento River is affected by a variety of factors, including weather, geology, water storage projects (reservoirs), tributary streams, agricultural runoff, municipal and industrial discharges, and non-point sources, such as instream transport of stream-bottom sediments with elevated levels of heavy metals, and importation of water from other watersheds. Water quality in the mainstem of the Sacramento River is affected by releases from Shasta Dam, which forms Shasta Lake. Water quality in Shasta Lake is affected largely by three tributaries (McCloud, Pit, and Sacramento rivers) and the geochemical and biochemical processes occurring within the reservoir.

Many of the Sacramento River tributaries downstream from Shasta Dam are also regulated by reservoirs, which affects their water quality. Spring Creek Reservoir releases water to Spring Creek (contaminated with acid mine drainage), which is tributary to Keswick Reservoir. Clear Creek was impounded to form Whiskeytown Reservoir, through which water from the Trinity River is diverted into the Sacramento River drainage. Stony Creek has three reservoirs including East Park, Stony Gorge, and Black Butte. The mainstem of the Feather River is regulated by Oroville Dam. Upstream from Lake Oroville, the North Fork is regulated by Pacific Gas & Electric Company dams, and the South Fork is regulated by the South Feather Water and Power Agency. Further downstream, Englebright Narrows Dam controls releases to the Yuba River, and Rollins Reservoir controls releases to the Bear River. Releases to Cache Creek are controlled at Clear Lake, and the North Fork of Cache Creek is controlled by Indian Valley Reservoir. River flows in Putah Creek are controlled by the Solano Dam. Folsom and Nimbus dams control flows in the American River. All of these waterbodies flow into the Sacramento-San Joaquin Delta (Delta)**.** The Delta includes rivers, islands and sloughs.

7.2.2.2 *Historic Water Quality of Reservoirs and Rivers*

The chemical quality of Sacramento River tributaries is directly related to the geology in the tributary drainage. Streams draining the igneous formations north and east of the Sacramento Valley are low in dissolved solids and electrical conductivity (EC)[6]. Streams from the coastal sedimentary formation are substantially higher in dissolved solids (salts), and therefore, exhibit higher EC values.

[6] Electrical conductivity (EC) is a measure of water's ability to conduct an electric current based on its dissolved salt content.

7.2.2.3 *Trinity River Basin Water Quality*

Trinity River water temperatures are influenced by Trinity and Lewiston reservoirs' release temperatures, flow rates, channel geometry, regional meteorology, and tributary flows and temperatures (the effect of Trinity and Lewiston reservoirs diminishes with distance downstream). Generally speaking, the greater the release volumes from the dams, the less susceptible the rivers temperature is to other factors. Trinity Reservoir releases tend to be cold (42°F to 47°F); whereas, Lewiston Reservoir, which is much shallower, tends to provide releases that are more affected by ambient temperatures.

During storm periods, turbidity in the Trinity River from Lewiston Dam to the South Fork is caused primarily by heavy inflows of suspended sediment from tributaries and the reservoirs. Highly erosive soils comprise approximately 17 percent of the Trinity River Basin, resulting in significant sediment loads entering the river. The reduced flows resulting from the construction and operation of the dams are partially responsible for sediment accumulation in the river. High flows, which historically flushed these sediments through the system, have become less frequent and of lower magnitude.

Elevated concentrations of mercury have been found in water, sediment, and biota (fish, frogs, and predatory aquatic insects) in the Trinity River Basin, similar to other river basins in California that have been subjected to historical gold mining operations (USGS, 2005). Sediment samples collected within and adjacent to some planned channel rehabilitation project sites of the Trinity River Restoration Plan contain mercury concentrations that are above what are considered naturally occurring levels.

Natural sources of mercury to the watershed may include wet and dry deposition of mercury from the atmosphere, and indigenous mercury that naturally occurs in rocks and soils. Some elemental mercury was likely introduced to the basin during gold mining operations. This elemental mercury was likely subject to chemical and biological processes that transform some of the elemental mercury into dissolved mercury phases that can become methylated. Sulfate-reducing bacteria in anaerobic environments are typically the source of methylation. The potential for methylation depends not only on solubility of mercury phases present, but also many other chemical variables, such as sulfate and organic carbon, and physical parameters such as temperature, pH, oxidation-reduction potential, and the bacterial community.

The primary source for gold in the Trinity River watershed is low sulfide quartz gold vein deposits. Gold in these deposits is commonly associated with pyrite and minor amounts of base metals. Weathering of these deposits may also cause locally elevated sulfate concentrations and enhance mercury methylation by exposure to sulfate-reducing bacteria. In the upper Trinity River Basin (upstream of Trinity Lake), the Altoona mercury mine in the East Fork Trinity River watershed releases mercury and sulfate that results in methylation of mercury and elevated levels of mercury in downstream plants and animals. Although natural mercury deposits are widespread in western California and are the source of mercury used in placer mining, the Altoona Mine is the only mercury mine in the Trinity Watershed. No information exists to indicate that methylmercury contamination from the Altoona Mine has migrated in significant amounts to areas downstream from Lewiston and Trinity dams, although some preliminary sampling efforts in the basin have been initiated.

Water quality in the lower Klamath River is regulated by the North Coast RWQCB. Standards for the Trinity River generally apply to the Klamath River because beneficial uses are similar, except that there are no time- and location-specific temperature objectives. Current water quality concerns in the Klamath River Basin are the result of agricultural practices, water management, timber harvesting activities, natural geologic instability, and mining operations. Water quality in the lower Klamath River can be influenced by dam releases from Iron Gate Dam on the Klamath River or dam releases from Lewiston

Dam on the Trinity River. Lower in the Klamath River, the effects of the high nutrient loads from the upper basin are typically diluted by tributary flow, including the Trinity River, the largest of its tributaries.

Lower Klamath River water temperatures may be influenced by releases from Iron Gate Dam. However, the Trinity River has a greater influence on water temperature of the Lower Klamath River than the releases from Iron Gate Dam. The two systems are different in that the coldwater storage of Trinity Reservoir is much greater than that of the upper Klamath River Basin reservoirs. Empirical data and a temperature model of the Trinity River has provided insight into the effects that variable Lewiston Dam releases may have on water temperatures at the confluence of the Klamath River at Weitchpec. Empirical data have shown the influence of a high Lewiston Dam release on Klamath River water temperatures. In June 1992, a 10-day Lewiston Dam release of 6,000 cubic feet per second (cfs) occurred and greatly influenced the temperature of the lower Klamath River. This release decreased temperature in the mainstem Klamath River (immediately downstream from the confluence) by nearly 4.5°F. Because 1992 was a Critically Dry water year, tributary accretion in both the Klamath and Trinity rivers was very small. As a consequence, the high release from Lewiston Dam resulted in the Trinity River becoming the dominant cold water source at the confluence. These interactions were confirmed during 2003 operations for late fall temperature maintenance.

Modeled dam releases from Lewiston Dam also provided assessments of the likely effects of releases on water temperatures at the confluence of the Klamath River during the spring and early summer. These evaluations focused on recommended flows identified in the analysis of alternatives, and the following generalities were identified from this evaluation. First, the model predicted that high-level releases can result in Trinity River water temperatures being colder than the Klamath River. Conversely, low-magnitude releases can result in Trinity River water temperatures becoming warmer than the Klamath River in the lower reaches. The main factor that can offset temperature differentials is likely the quantity of tributary accretion. When the Lewiston Dam release is large during Drought conditions (low tributary accretion) or small during Wet conditions, the temperature differentials become greatest. Marked temperature differentials may have a harmful effect on sensitive fishery resources. When dam release magnitudes are matched to emulate pre-TRD hydrologic conditions, the differences are lessened.

7.2.2.4 *Shasta Lake and Vicinity Water Quality*

Water quality in this portion of the Secondary Study Area generally meets the standards for beneficial uses identified in the Central Valley Basin Plan. The quality of surface waters in Shasta County is generally considered good. The following nonpoint pollution sources could affect surface water quality: high turbidity from controllable sediment discharge sources (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; and warmwater discharges into coldwater streams.

The surface water quality of streams and lakes draining the Shasta-Trinity National Forest (STNF) and adjacent private lands generally meets standards for beneficial uses defined by the Central Valley Basin Plan. There are, however, some areas where the water quality does not meet the standards during periods of stormwater runoff because of past management activities. The cumulative impacts of successive activities, such as road construction and timber harvesting on private and National Forest lands, also contribute to the degradation of water quality in the STNF (USFS, 1995).

Approximately 6.2 million acre-feet of water flows annually into Shasta Lake from the Sacramento, McCloud, and Pit River drainages. A favorable inflow-outflow relationship of 1.4 to 1 results in good water quality, both in the lake and downstream (Reclamation, 2011).

Nutrient inputs and bacteria are not of concern in the Sacramento River and McCloud River arms (Reclamation, 2011); however, they could be an issue in the Pit River Arm as a result of runoff from agricultural and range lands in the upper Pit River watershed. Within Little Backbone Creek, Dry Creek, and the Squaw Creek Arm, the waters are locally limited by low pH and elevated concentrations of heavy metals caused by drainage from abandoned mines (Reclamation, 2011). In addition, data suggest that sediment and turbidity locally affect beneficial uses, mainly contact recreation.

7.2.2.5 *Sacramento River Water Quality – Upper Reach*

Shasta Lake is a major controlling factor of water quality in the upper reach (Keswick Dam to Red Bluff Diversion Dam [RBDD]) of the Sacramento River. The main source of water in the Sacramento River downstream from Keswick Dam is snowmelt that collects in upstream reservoirs and is released in response to water needs or flood control. The quality of surface water downstream from Keswick Dam is also influenced by other human activities along the Sacramento River downstream from the dam, including agricultural, historical mining, and municipal and industrial inputs (Reclamation, 2011).

Water quality in the Sacramento River is relatively good. Only during conditions of stormwater-driven runoff are water quality objectives typically not met. Water quality issues within the upper reach of the Sacramento River include the presence of mercury, organochlorine pesticides, trace metals, turbidity, and toxicity from unknown origin (CALFED as cited in Reclamation, 2011). Nutrients, such as nitrate, were found to be low throughout the Sacramento River basin. Water temperature is a principal water quality issue in the upper reach of the Sacramento River.

Significant tributaries flowing to the Sacramento River in this reach include Cow, Bear, Battle, and Paynes creeks from the east, and Spring, Clear, and Cottonwood creeks from the west. Since full operation of the TRD began in 1964, an average of 74 percent of the basin's inflow to the TRD (approximately 988,000 acre-feet) has been exported to the CVP annually. As of 2000, annual exports have decreased to an average of 732,400 acre-feet (Reclamation, 2000). Major discharges to the upper Sacramento River include treated sewage from the cities of Redding, Anderson, and Red Bluff. Industrial discharges are limited; the only significant potential discharge occurs from the Sierra Pacific Industries lumber mill located near Anderson. Previous significant industrial discharges had occurred from the Simpson Lee Paper Products mill located near Anderson, from which dioxin was discharged to the river.

Water temperatures in the upper reach during the summer are substantially cooler than prior to construction of Shasta Dam due to deep water releases from the reservoir made possible by the installation of a Temperature Control Device (TCD). The Shasta TCD was first operated in 1997. Winter temperatures are warmer than pre-Shasta Dam conditions due to heat stored in the reservoir. The combined effects of heat trapped during cool months and deep water releases during warm months have narrowed the seasonal range of temperatures in the upper reach of the Sacramento River Winter and spring river temperatures are relatively constant from Keswick Dam to Red Bluff, and summer and fall temperatures increase with distance downstream.

Settling of particulate matter in Shasta Lake results in low levels of suspended solids, turbidity, and discoloration (a narrative aesthetic criteria), in the river downstream from Keswick Dam (DWR, 1962, 1970). Lowest turbidity in this reach of the river occurs under low flow conditions during the summer and early fall, but increases slightly as the river flows from Keswick Dam to Red Bluff (DWR, 2012). Turbidity spikes occur during major storms, with the largest inputs coming from major tributaries (such as Cottonwood Creek) and bank erosion.

The pH in the upper reach generally ranges from approximately 6.6 to 8.0 (DWR, 2012). The pH remains relatively constant from Keswick Dam to Red Bluff, with no readily apparent seasonal trends.

EC in the tributaries to the upper reach of the Sacramento River is highest during low flow conditions of late summer and early fall due to dissolution of minerals in the substrate, and lowest during winter and spring due to dilution from higher flows. EC in the upper Sacramento River is controlled by water quality in Shasta Lake. It is lowest in the summer months and peaks occur during the winter (DWR, 2012). Highest EC occurs in the deeper waters during the winter, and lowest values occur in the summer (DWR, 2012). Higher EC in the winter in the reservoir is the result of increased mineralization from turbid tributary inflows, and lower EC during the summer occurs due to settling of materials from the water column.

Dissolved oxygen concentrations in the upper river are usually high, ranging from 9.5 to 12 milligrams per liter (mg/L) near Redding with greater than 95 percent saturations (DWR, 1962).

Nutrient levels are generally low in the upper reach of the river (DWR, 1970, 1973). Lowest levels of total phosphorus occur during the summer months, which may be due to uptake of nutrients by periphyton[7]. Total phosphorus was not found at levels exceeding 0.05 mg/L for this reach of the river.

One of the major sources of water quality degradation in this reach of the river stems from heavy metal contamination from acid mine drainage upstream from Keswick Dam. Heavy metals and acid are released by oxidation of massive fine-grained sulfide ores in abandoned surface mines, subsurface mines, and tailings. the resultant acidic solution causes further dissolution of heavy metals from the ores. Periodic fish kills investigated by the California Fish Commission since 1899 have been attributed to extremely acidic waters with high concentrations of iron, copper, zinc, cadmium, aluminum, and other heavy metals (USEPA, 2006).). Several tributaries to Shasta and Keswick reservoirs carry high concentrations of dissolved metals. As of 2006, acid mine drainage still escaped untreated from waste piles and seepage on the north side of Iron Mountain and flowed into Boulder Creek. USEPA continues to investigate and plan future actions to control acid mine drainage in the Boulder Creek catchment.

In 1983, USEPA placed the Iron Mountain Mine (IMM), which is the principal discharger of acid mine drainage in the Spring Creek watershed, on the National Priorities List (Superfund Site), and initiated actions to prevent formation of acid mine drainage. The acid mine drainage from IMM is among the most acidic and metal-laden anywhere on Earth. In 1989, USEPA removed tailings to a disposal cell near the top of Iron Mountain, and in 1994 a water treatment plant was built at Minnesota Flats. This facility, which has been expanded and upgraded since it was first constructed, uses lime (calcium oxide, CaO) to neutralize the acid. USEPA estimates that these cleanup actions control more than 99 percent of the copper, cadmium, zinc, and other metals that historically discharged to the Sacramento River. USEPA is now focusing actions on removing sediments contaminated by the previous acid mine discharges from the Spring Creek arm of Keswick Reservoir (USEPA, 2006).

[7] Periphyton are micro-organisms attached to, and living on, submerged solid surfaces and are useful indicators of water quality.

7.2.2.6 *Sacramento River Water Quality – Middle Reach*

The middle reach (RBDD to Colusa) of the Sacramento River flows mostly through recent alluvium and has formed a floodplain that ranges from one to five miles wide. The gradient decreases from approximately 2.5 feet per mile at Red Bluff to 1.3 feet per mile near Colusa. A regular riffle-pool sequence is evident in unaltered areas, but is less apparent in the river downstream from Princeton. The riverbed is essentially gravel and cobble in the upper portions of this reach, with gravel becoming less apparent downstream from the confluence of Stony Creek at river mile (RM) 190. Near Colusa, the riverbed is predominantly coarse sand with gravel occurring in crossover areas (DFG, 1982).

Tributary inflows of some significance in the middle reach of the Sacramento River include Antelope, Mill, Deer, and Big Chico creeks from the east, and Elder, Thomes, and Stony creeks from the west. Agricultural diversions are common in this reach of the river. Some of the major diversions include the Corning, Tehama-Colusa (T-C), Glenn-Colusa Irrigation District (GCID), Provident Irrigation District, and River Branch canals. In addition, several smaller diversions by private farming interests are present in this reach.

Winter water temperatures in the middle reach generally range from 45°F to 50°F (DWR, 2012) and decline in a downstream progression (DWR, 1962). Water temperatures in this reach during the rest of the year are higher than those in the upper reach and increase as the river flows from Red Bluff to Colusa. The most dramatic increases in temperatures predictably occur during warm periods with low flow (late summer and early fall). In addition, seasonal and diurnal fluctuations of water temperatures in this reach are greater than the upper reach, which is due largely to the river moving toward equilibrium with atmospheric conditions as it flows further from Shasta Reservoir.

Suspended solids, turbidity, and discoloration have been found to increase in a downstream progression (DWR, 1962, 1970, 1973). However, during late summer and early fall, when turbidities are lowest, the trend is far less evident. Turbidity levels are highest during the winter and early spring, due to tributary runoff and bank erosion from higher flows (DWR 1970, 1973). Some of the highest suspended solids levels observed were found early in the winter of 1978, with some levels showing a five-fold increase over historic data. This was due largely to heavy accumulations of sediments that occurred during the drought years of 1976 and 1977 (DWR, 1979).

The median pH of this reach of the river was found to be 7.3 (DWR, 1962); data collected from 1998 to 2012 show that pH ranges from 6.3 to 8.4 (DWR, 2012). The pH of the middle reach is slightly greater than the upper reach, particularly during late summer and early fall.

EC continues to increase in a downstream progression in this reach, with levels nearly always higher in this reach than in the upper reach (DWR, 2012). Data collected from 1998 to 2012 show EC in the upper reach ranging from 79 to 136 µmhos/cm, while ranging in the middle reach from 81 to 170 µmhos/cm. Typically, lowest EC in the river occurs during the summer, and highest levels occur in the winter. This seasonal difference in EC appears to be related to the limnology and operation of Shasta Reservoir. However, hydrologic factors operating in various years can alter this pattern. In 1960 to 1961, EC was lowest during the spring due to dilution from snowmelt runoff (DWR, 1962). In 1970, lowest EC levels in the river occurred during a series of January storms that caused excessive flooding, which resulted in dilution of mineral loads.

Nutrient levels tend to increase during the winter and in a downstream direction (DWR, 1970, 1973). Total phosphorus levels were nearly always higher in the middle reach than the upper reach of the Sacramento River.

7.2.2.7 *Sacramento River Water Quality – Lower Reach*

Water quality in the lower reach (Colusa to Verona) of the Sacramento River is affected by agricultural runoff, acid mine drainage, stormwater discharges, diversions, urban runoff, and water releases from dams. However, the flow volumes generally provide sufficient dilution to prevent excessive concentrations of contaminants in the river.

Several TMDLs are currently proposed for the lower reach of the Sacramento River. In addition, the Sacramento River downstream from RBDD to Knights Landing is listed as an impaired water body pursuant to Section 303(d) of the Clean Water Act (CWA) for mercury and unknown toxicity.

Elevated metals and pesticide levels have been found at some sites in the Sacramento River Valley downstream from Knights Landing. The parameters of concern in the Sacramento River from Knights Landing to the Delta include diazinon, mercury, and unknown sources of toxicity (SWRCB, 2007).

The Colusa Basin watershed covers approximately 1 million acres in Glenn, Colusa, and Yolo counties (WRA, 2007). The Colusa Basin Drain (CBD) is designed to convey drainage flows from agricultural lands and 32 ephemeral streams during the irrigation season to the Knights Landing outfall gates and stormwater flows during the winter. The Colusa Bain Drain drains approximately 1,620 square miles in the Sacramento Valley, and includes portions of Glenn, Colusa, and Yolo counties. The Canal starts in Glenn County northeast of the city of Willows and runs in a southerly direction for 70 miles to Knights Landing in Yolo County.

Water quality in this reach is influenced by agricultural drainage and the Feather River. Significant quantities of suspended sediments, turbidity, dissolved solids, minerals, and nutrients, as well as pesticides in some cases, are added to the Sacramento River via the CBD. The fifth Annual Monitoring Report for the Sacramento River Watershed Program (SRWP, 2004) reported monitoring results collected from 1997 to 2003. Drinking water parameters of potential concern included in the SRWP monitoring program include organic carbon, total dissolved solids, pathogens, turbidity, and nutrients. Organic carbon is of concern primarily due to its role in the creation of carcinogenic trihalomethanes (THMs) and other disinfection by-products during disinfection of source water.

Total dissolved solids (TDS) can have an important effect on the taste and palatability of drinking water, and at very high levels may cause health problems in sensitive individuals. The presence of high levels of TDS may also be objectionable to consumers owing to the resulting excessive scaling in water pipes and fixtures, heaters, boilers, and household appliances.

The highest concentrations of most drinking water parameters of concern were generally observed in agricultural drains (Sacramento Slough and CBD) and in urban drainages and creeks (Natomas East Main Drain, Arcade Creek) (SRWP, 2004). Concentrations of methylmercury in particulate matter (expressed as nanograms of particulate methylmercury per gram of suspended solids) in the mainstem exhibit no apparent spatial trend between Hamilton City and Greene's Landing (SRWP 2004). The CBD and Sacramento Slough exhibited methylmercury concentrations in particulates that were similar to the lower mainstem Sacramento River, but with much higher concentrations of suspended solids. Concentrations of methylmercury in particulates were dramatically higher in the major tributaries than in the mainstem.

The Feather River provides a substantial quantity of high quality water that generally meets the standards for beneficial uses identified in the Central Valley Basin Plan, to the Sacramento River. The Feather River originates in the volcanic formations of the Sierra Nevada Range and flows southwest to Oroville, where it is impounded behind Oroville Dam. The dam provides coldwater releases to the Feather River from deep within Lake Oroville, a thermally stratified lake. From Oroville, the Feather River flows south through the Sacramento Valley where it is joined by two major tributaries. The Yuba River joins the Feather River at Marysville; the Bear River has its confluence approximately 15 miles farther downstream. The Feather River then joins the Sacramento River at RM 80. The Feather River is generally lower in turbidity, suspended solids, dissolved solids, EC, and nutrients than the Sacramento River (DWR, 2004).

Water temperatures in this reach of the Sacramento River continue to increase in a downstream progression, except during the winter months when temperatures either decline slightly or hold fairly constant as the river flows downstream (DWR, 1962). During most of the year, water temperatures increase downstream from the CBD outfall (and then decline downstream from the Feather River confluence (USGS, 1978, as cited in DWR, 1986). The Feather River is warmer in August than the Sacramento River, resulting in continued warming downstream from their confluence (USGS, 1978, as cited in DWR, 1986).

Seasonal and diurnal temperature fluctuations are greater in this reach than in the upper two reaches (DWR, 2004). Temperatures in this reach have varied from 48°F in January 1984 to 71°F in August 1983.

Turbidity, as well as suspended solids and color, are also greater in this reach than in the upper reach, which is due largely to irrigation return flows, erosion, and algal production (DWR, 1962). However, the pattern is less evident during the late summer and early fall when flows and turbidities are lowest. Highest turbidity levels occur during periods of high rainfall and increased flows (DWR, 1970). The increase in turbidity as the Sacramento River flows downstream is interrupted at the confluence with the Feather River. The inflowing low turbidity water of the Feather River results in decreased turbidity in the Sacramento River downstream from their junction. Turbidity in this reach has been found to range from 2.5 FTUs8 in October to 46 FTUs during a storm in late November.

Monitoring results from the 2011 Annual Monitoring Report (AMR) of the Sacramento Valley Water Quality Coalition identified several herbicides and pesticides above laboratory detection levels including disulfoton from Sacramento Slough at Karnak, and Malathion, methomyl metolachlor, oxyfluorofen, simazine, and chlorpyrifos from the CBD at Highway 20 (SVWQC, 2012). However, these levels did not exceed Central Valley Basin Plan criteria or result in exceedences of sediment toxicity thresholds. The report identified three monitoring events when dissolved oxygen levels failed to meet objectives to protect the COLD beneficial use (7.0 mg/L), and one that failed to meet the WARM beneficial use goal (5.0 mg/L). On four monitoring events at the CBD at the Highway 20 location, measured EC levels failed to meet the Agricultural goal of 700 µmhos/cm, with two of these events also exceeding the California recommended 2° Maximum Contaminant Level of 900 µmhos/cm for drinking water. Monitoring results for E. coli, nutrients, pH, and trace metals met relevant Central Valley Basin Plan goals.

EC in this reach follows a pattern similar to the upper two reaches. Historical data indicate that EC is generally higher in the winter and lower in summer. However, hydrologic conditions interrupt this pattern from time to time. EC in 1970 was lowest during a January flood (DWR, 1970), but has been lowest at

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[8] The most widely used measurement unit for turbidity is the FTU (Formazin Turbidity Unit).

other times in the spring due to heavy runoff from snowmelt (DWR, 1962). In addition, agricultural practices in this reach may interrupt the seasonal pattern. EC was found to increase substantially during mid-September 1983, which corresponds to the period that rice fields were drained for harvest. EC during 1983 and 1984 ranged between 115 and 175 µmhos/cm.

EC in the lower reach of the river is greater than in the upper two reaches (DWR 1970, 1973). Substantial increases have been noted downstream from the CBD outfall.

DWR (1990) indicated that irrigation return waters increase EC in the river during most of the year, except during the spring.

The trend of increasing EC as the river moves downstream is interrupted at the confluence with the Feather River. The Feather River has lower EC than the Sacramento River, which results in lower EC in the Sacramento River downstream from the confluence with the Feather River (DWR, 1962, 1970, 1973). Nutrient concentrations in this reach tend to increase in a downstream progression, but decrease downstream from the confluence of the Feather River (DWR, 1970, 1973). Phosphorus and carbon concentrations are higher in the Sacramento River than in the Feather River. Nutrient concentrations are nearly always higher in the agricultural drains than the mainstem and result in increased concentrations in the river downstream from their outfalls.

Dissolved oxygen fluctuates more in this reach than in the upper reaches (DWR, 2004), which is due largely to seasonal temperature regimes. Concentrations of oxygen are highest in the winter when temperatures are lowest, and are lowest in the summer when temperatures are highest. Dissolved oxygen concentration decreases slightly downstream, due to increased temperatures and increased waste discharges (DWR, 1962). The Feather River, for the most part, has higher concentrations of oxygen than the Sacramento River. However, during low flow conditions, when the Feather River sometimes becomes warmer than the Sacramento River, dissolved oxygen may be higher in the Sacramento River. The diurnal dissolved oxygen cycle in this section of the river follows a predictable pattern. During August, oxygen concentrations increase in the afternoon due to photosynthetic activity and then decline at night (USGS,1978, as cited in DWR, 1986). Similar trends are seen in the Feather River during the same period. During November, however, no clear diurnal dissolved oxygen cycles were observed in the Feather River and Sacramento River downstream from the Feather River. Dissolved oxygen levels never declined significantly, indicating no waste assimilation problems in this reach.

7.2.2.8 *Lower Feather River Water Quality*

The quality of water in Lake Oroville is affected largely by upstream tributaries. Water released from Oroville Dam determines water quality downstream in the Feather River, which subsequently determines water quality in the Thermalito Forebay and Afterbay (DWR, 2004).

Thermal stratification during the summer in Lake Oroville occasionally leads to reduced dissolved oxygen conditions near the bottom of the water column. Nutrients and minerals in the reservoir were found at levels consistent with existing and proposed criteria, except for total phosphorus, which was occasionally at levels exceeding concentrations in the upstream tributaries and recommended water quality criteria. Metals exceeding various criteria in the reservoir included arsenic, aluminum, copper, iron, manganese, and lead. However, these and other metals are contributed to the reservoir in concentrations exceeding various criteria by the upper tributaries.

Water temperatures downstream from Oroville Dam are controlled by temperature requirements at the Feather River Fish Hatchery and Robinson Riffle. Releases are made from the reservoir to provide temperatures suitable for fish propagation at the hatchery, which also generally meets temperature requirements at Robinson Riffle. Water released from the reservoir to comply with fishery temperature needs conflicts with temperature requirements for other beneficial uses, such as irrigation.

Water quality in the Feather River downstream from Oroville Dam is affected by the reservoir. Dissolved oxygen levels in the Feather River are infrequently found at levels less than those suitable for beneficial uses. Turbidity levels in the river downstream from the dam are less than those measured in tributaries to Lake Oroville, indicating that the reservoir acts as a settling basin for the turbid inflows. Nutrients and minerals downstream from Oroville Dam are at levels suitable for all beneficial uses. Metals in the Diversion Pool at the base of the dam reflect the quality of water in the reservoir near the dam. Further downstream, accretions to the river from tributaries, storm drains, surface runoff, and other sources affect water quality in the river. Metals occasionally exceeding various criteria in the Feather River downstream from the Fish Barrier Dam include aluminum, arsenic, cadmium, copper, iron, and mercury.

Metals occasionally exceeding criteria in features of the Thermalito Complex include aluminum, arsenic, cadmium, iron, manganese, and lead. Some ponds in the Oroville Wildlife Area also occasionally were found with reduced oxygen levels, and elevated levels of aluminum, arsenic, iron, and manganese.

Pesticides are not found in the lower Feather River, though diuron was found upstream from Lake Oroville in the South Fork Feather River. MTBE was detected in the Diversion Pool.

Both total and fecal coliform bacteria are found from all water quality monitoring sites, but only fecal coliform bacteria exceed criteria. Total and fecal coliform and enterococcus bacteria are found at all swim areas and are present at some swim areas at densities greater than criteria. In addition to human contact with water, high wildlife use of the swim areas could contribute bacterial contamination.

The phytoplankton communities in Lake Oroville and the Thermalito Complex are dominated by diatoms; green algae are dominant in ponds in the Oroville Wildlife Area. Periphyton communities in the river are also generally dominated by diatoms, which are indicative of aquatic ecosystems that are not nutrient rich.

Aquatic macroinvertebrates in the Feather River are dominated by species that adapt readily to disturbed ecosystems. The species composition in the river near the dam is typical of that downstream of large reservoirs. Further downstream, habitat conditions allow additional species to colonize.

Sites both upstream and downstream from Lake Oroville produced toxic effects to test organisms in bioassays. Both survival and reproduction of *Ceriodaphnia* (a water flea) and survival and growth of fathead minnow are affected.

Total suspended and settleable solids are usually reported at very low levels in both upstream tributaries and the lower Feather River. Highest total suspended and settleable solids levels are usually found during winter months.

Water quality in the Feather River is potentially affected by treated sewage discharged through the Sewage Commission Oroville Region (SCOR) Outlet to the Feather River downstream from the Afterbay Outlet. Monitoring of gravels and water upstream and downstream from the SCOR Outlet produce variable results.

Periphyton and macroinvertebrate communities in the tributaries to Lake Oroville are indicative of healthy ecosystems. Both periphyton and macroinvertebrate communities are similar to those found in the Feather River downstream from Oroville Dam in the low-flow section, as well as other streams in which anadromous salmonids spawn. Comparisons of the periphyton and macroinvertebrate communities in the upper tributaries with communities in the low-flow channel and other streams do not indicate that the upstream tributaries suffer from nutrient deprivation due to purported blockage of salmonid spawning in the upper tributaries caused by Oroville Dam.

7.2.2.9 *Lower American River Water Quality*

Surface water quality in Folsom Reservoir, Lake Natoma, and the lower American River depends primarily on the mass balance of various water quality constituents from groundwater inputs, tributary inflow, permitted discharges from municipal and industrial sources, indirect watershed runoff (unchannelized flow), urban runoff, and stormwater discharges (Reclamation, 2009). Water quality varies somewhat among years and seasonally within a year, based primarily on these and related factors. The South Fork American River, which contributes to Folsom Reservoir and Lake Natoma, is listed as impaired for mercury; the American River segment from Nimbus Dam to the confluence with the Sacramento River is listed as impaired for both mercury and unknown toxicity.

Historically, water quality parameters for the lower American River have typically been well within acceptable limits to achieve water quality objectives and beneficial uses identified for this waterbody and remain so today. Principal water quality parameters of concern for the river (e.g., pathogens, nutrients, total dissolved solids (TDS), total organic carbon (TOC), priority pollutants, and turbidity) are primarily affected by urban land use practices and associated runoff and stormwater discharges. The stormwater discharges to the river temporarily elevate levels of turbidity and pathogens during and immediately after storm events. TOC and TDS levels in the lower American River are, however, relatively low compared to Sacramento River and Delta waters, and thus, are generally not of substantial concern.

Although urban land use practices, urban runoff, and stormwater discharges all contribute priority pollutants to the river, monitoring results conducted from 1998 to 2001 by the Sacramento River Watershed Program did not identify any priority pollutant at concentrations consistently above State water quality objectives (SRWP, 2004). However, water quality objectives for dissolved oxygen, temperature, and pH are not always met in the lower American River. Finally, taste and odor problems occasionally arise (generally during the late summer months) in the domestic water supplies taken from the lower American River at the Fairbairn Wastewater Treatment Plant.

Water released from Folsom Reservoir through Lake Natoma and into the lower American River can affect several water quality parameters in the river. In addition, operation of Folsom Dam and Reservoir directly affects lower American River temperatures throughout much of the year. Water temperatures in the lower American River are often unfavorably high for salmonids during the summer and fall months of the year. Elevated river temperatures can be particularly problematic to the river’s salmonid resources during low-flow conditions, which occur during the drier years.

7.2.2.10 *Sacramento-San Joaquin Delta Water Quality*

Water quality in the Delta is highly variable temporally and spatially and is a function of complex circulation patterns that are affected by inflows, pumping for Delta agricultural operations and exports, operation of flow control structures, and tidal action. The existing water quality problems of the Delta system may be categorized as the presence of toxic materials, nutrient enrichment (eutrophication), and associated fluctuations in dissolved oxygen, the presence of suspended sediments and turbidity, salinity, and the presence of bacteria (Reclamation, 2011).

The Delta waterways within the area of Central Valley RWQCB's jurisdiction are listed as impaired on USEPA's 303(d) list for dissolved oxygen, EC, DDT, mercury, Group A pesticides, diazinon and chlorpyrifos, and unknown toxicity (SWRCB, 2007). The Delta, which is within the jurisdiction of the San Francisco Bay RWQCB, is listed as impaired for mercury, chlordane, selenium, DDT, dioxin compounds, PCB compounds, dieldrin, diazinon, exotic species, and furan compounds (SWRCB, 2007).

Organic carbon in the Delta originates from runoff from agricultural and urban land, drainage water pumped from Delta islands that have soils with high organic matter, runoff and drainage from wetlands, wastewater discharges, and primary production in Delta waters. Delta agricultural drainage can also contain high levels of nutrients, suspended solids, organic carbon, minerals (salinity), and trace chemicals, such as organophosphate, carbamate, and organochlorine pesticides.

Water temperatures and dissolved oxygen levels in the Delta and Lower San Joaquin River can act as a barrier to salmon migration and survival, and introduced aquatic invasive species and Delta pumping for export also affect native aquatic species survival.

Applicable California RWQCB impaired waters for the Secondary Study Area include SWRCB Regions 1 and 5 are listed in Appendix 7A. Applicable Central Valley Basin Plan water quality criteria (CVRWQCB, 2011) are listed in Appendix 7B.

7.2.3 Primary Study Area

7.2.3.1 *Overview and Methodology*

The proposed Project features are located in Glenn and Colusa counties west of the Sacramento River, and extend into the Coast Range foothills. Elevations within these counties range from approximately 35 feet along the Sacramento River to 3,000 feet in the foothills. This area is characterized by seasons of hot dry summers and moderately cold moist winters. Summer temperatures commonly exceed 100°F. Approximately 95 percent of the annual precipitation occurs during the winter months. Precipitation ranges from approximately 18 inches per year on the valley floor, 21 inches per year at Stony Gorge Reservoir, and 51 inches per year at the upper elevations of the Coast Range crest. Precipitation generally approaches the area from the west, is highest at the Coast Range crest, and diminishes as elevations drop toward the Sacramento Valley in a "rain-shadow" effect.

The proposed Sites Reservoir would impound Stone Corral and Funks creeks, as well as inundate Salt Lake. The chemical quality of waters in this area is directly related to the geology in the tributary drainage, as well as agricultural and cattle grazing land uses. Streams from the coastal sedimentary formation are substantially higher in dissolved solids and EC than the Sacramento River.

DWR began monthly sampling of streams in the Primary Study Area in 1997, including physical parameters, nutrients, minerals, and metals in the water column (DWR, 2012), as well as mercury analysis of sport fish tissues collected from nearby existing reservoirs, including East Park, Stony Gorge, and Black Butte (DWR, 2007). Routine water quality monitoring by DWR was periodically suspended due to funding limitations during portions of 2008 and 2009, and ended following the January 2010 monitoring run. Sampling results were then compared to Central Valley Basin Plan water quality criteria (CVRWQCB, 2011) (Appendix 7B) and USEPA ambient water quality criteria to prevent nuisance algal growth in streams (USEPA, 2001).

7.2.3.2 *Water Quality*

Existing Nearby Reservoirs

East Park and Stony Gorge reservoirs were sampled during the summer of 2000 to evaluate the extent of mercury contamination in fish because these reservoirs are representative of conditions that could be expected in the proposed Sites Reservoir. DWR analyses of total recoverable mercury indicate that levels in samples collected near the bottom of the water column at Stony Gorge and Black Butte reservoirs,exceeded the California Toxics Rules (CTR) for protection of human health. Methylmercury is assumed to be the form of mercury available for bioaccumulation in the food web. Most mercury in fish tissues is in the methylmercury fraction. Total mercury, however, is typically analyzed from fish tissue and is assumed to represent the methylmercury content of tissues.

Fish tissue samples were collected by DWR from East Park and Stony Gorge reservoirs during 2000 to 2001. Neither catfish nor bass composites collected from East Park Reservoir exceeded the OEHHA screening value or USEPA criterion, although mercury levels in the small-sized bass approached these values, and a very large channel catfish that was analyzed individually contained tissue mercury at over twice the level of the screening value and criterion limits. Mercury concentrations in tissues of channel catfish collected from Stony Gorge Reservoir contained levels less than the screening value and criterion (DWR, 2007).

Salt Lake

Salt Lake, located within the proposed Sites Reservoir inundation area, is a 28-acre area of impounded water and seasonal wetlands formed by warm salt springs that occur upslope Salt Lake was sampled on a few occasions during 1997 to 1998; therefore, it is difficult to make an assumption regarding the quality of water from this location. From these samples, it was found that waters from this location are extremely high in minerals. The EC value on one occasion reached 194,100 micromhos per centimeter. The TDS measurement at this time was 258,000 mg/L. EC, TDS, sodium, and boron exceeded all Central Valley Basin Plan criteria. A few metals also were noted at very high concentrations (aluminum, iron, and manganese) and exceeded all criteria, and a few others exceeded some criteria (arsenic, copper, lead and nickel). Levels of ammonia and orthophosphate also were noted at high levels and exceeded criteria. Temperatures from this site were variable, and probably depend on seasonal conditions. Concentrations present in water from this site likely depend on the season and flow.

Funks Creek

Funks Creek originates at approximately 850 feet elevation in the foothills west of Antelope Valley. The banks of this intermittent stream are heavily eroded and the gravel bed is highly disturbed and compacted by cattle. Along the north end of Antelope Valley, Funks Creek receives underground drainage from Salt Lake. Funks Creek widens as it cuts through Logan Ridge and enters the western side of the Sacramento Valley, although flows are still intermittent. Approximately one mile downstream from Logan Ridge, Funks Creek is impounded by Funks Reservoir. This reservoir is fed mainly from waters of the T-C Canal. Downstream from the reservoir, Funks Creek is bordered by agricultural lands, and much of this reach is channelized before emptying into Stone Corral Creek. This portion of Funks Creek likely has some flow year round, due to leakage from the dam at Funks Reservoir.

DWR identified total aluminum levels that exceed Central Valley Basin Plan criteria for protection of aquatic life at the Funks Creek at GCID Canal station. The highest levels of total aluminum were present during storm-related high flow events occurring in the winter months. Arsenic levels consistently met the final USEPA arsenic rule establishing a new MCL of 10 µg/L for total arsenic. However, all water samples analyzed for arsenic from this stream exceeded the much lower California Public Health Goal of 0.004 µg/L. Although copper levels did not exceed criteria in Funks Creek, due to high water hardness, the levels were elevated and would contribute to copper loads imported to the reservoir from Sacramento River diversions. Total recoverable iron levels in Funks Creek ranged as high as 25,200 µg/L during storm-related high flow events. Iron levels also exceeded drinking water, agricultural water, and aquatic life protection criteria. Dissolved iron concentrations were generally below the Central Valley Basin Plan objective. Total recoverable manganese levels occasionally exceeded drinking water standards in Funks Creek, and the Agricultural Goal was rarely exceeded. DWR analyses of total recoverable mercury in Funks Creek indicated levels approached, but did not exceed, the CTR of 50 nanograms per liter (ng/L) for protection of human health. Total recoverable nickel levels in Funks Creek occasionally exceeded the Public Health Goal; total phosphorus levels were at or above the recommended criteria range of 10 to 20 µg/L to prevent excess algal growth.

Stone Corral Creek

Stone Corral Creek originates at approximately 700 feet elevation in the foothills west of Antelope Valley. As the intermittent stream flows into the grasslands of Antelope Valley, the channel is narrow and the banks eroded. The much larger Antelope Creek flows into Stone Corral Creek from the south near the town of Sites. Stone Corral Creek flows through the gap in the foothills and into the western Sacramento Valley.

DWR identified total aluminum levels that exceeded criteria for protection of aquatic life at the Stone Corral Creek near Sites station. As was described above for Funks Creek, samples from Stone Corral Creek also consistently met the final USEPA arsenic rule, and all samples were found at levels that exceeded the Public Health Goal. Stone Corral Creek had hardness levels much higher than found in Funks Creek. Copper levels analyzed from Stone Corral Creek exceeded the hardness-dependent criteria twice. The Central Valley Basin Plan level for dissolved copper was not exceeded in Stone Corral Creek samples.Total recoverable iron levels in Stone Corral Creek ranged as high as 7,420 µg/L during storm-related high-flow events, and occasionally exceeded drinking water and aquatic life criteria, as well as agricultural goals. Dissolved iron concentrations were generally below the Central Valley Basin Plan objective. Total manganese levels occasionally exceeded drinking water standards and very rarely exceeded the Agricultural Goal.

As described for Funks Creek, total recoverable mercury measured in Stone Corral Creek did not exceed any criteria. Nickel levels rarely exceeded the Public Health Goal, and nearly half of the samples collected exceeded the aquatic life criterion for total selenium. Total phosphorus levels measured in Stone Corral Creek ranged as high as 450 µg/L during a sampled high flow event. All samples contained total phosphorus at levels at or above the recommended criteria range to prevent nuisance algal growth in streams.

Tehama-Colusa Canal

The intake for the T-C Canal occurs at the southeast end of the City of Red Bluff at RM 243. The intake occurs downstream from the mouth of Red Bank Creek at the RBDD. The T-C Canal is approximately 111 miles long and extends from Red Bluff in Tehama County to downstream from Dunnigan in Yolo County. Funks Reservoir is approximately 66 canal miles downstream from RBDD.

DWR sampled the T-C Canal downstream from the siphon under Stony Creek. Aluminum levels rarely exceeded criteria for drinking water, aquatic life protection, and the agricultural goal. Arsenic levels exceeded human toxicity criteria during all sampling events, and cadmium levels rarely exceeded human toxicity criteria. Iron levels in the canal occasionally exceeded drinking water standards. All samples contained total phosphorus at levels at or above the recommended criteria range to prevent nuisance algal growth in streams.

Glenn-Colusa Irrigation District Canal

The intake for the GCID Canal is on a side channel off the Sacramento River at RM 205.5, north of the town of Hamilton City. GCID's Hamilton City pump station, located at the intake, diverts water into the GCID Canal from the Sacramento River for distribution within the GCID service area. The canal is an unlined earthen channel that stretches approximately 65 miles from the system diversion point near Hamilton City to its downstream southern terminus at the CBD near Williams, in Colusa County.

Total aluminum levels in the GCID Canal (GCID Canal at Intake station) frequently exceeded aquatic life criteria during associated high flow conditions in the Sacramento River, and rarely exceeded drinking water criteria and the agricultural goal. Arsenic levels exceeded human toxicity thresholds in all samples collected, and the criterion for protection of aquatic life for cadmium was exceeded in fifty percent of samples collected. Copper levels frequently exceeded hardness-dependent aquatic life protection criteria during high flow conditions in the Sacramento River at the intake to the canal, and iron levels frequently exceeded drinking water and aquatic life protection criteria, as well as the agricultural goal during the same river conditions. Dissolved iron levels exceeded the Central Valley Basin Plan objective occasionally. Mercury levels approached, but did not exceed, the CTR criterion during the highest flow conditions in the river. Manganese levels in the GCID canal occasionally exceeded drinking water standards and the agricultural goal, and lead levels rarely exceeded drinking water criteria. All samples contained total phosphorus at levels at or above the recommended criteria range to prevent nuisance algal growth in streams.

Colusa Basin Drain

The CBD is a human-made channel located in Glenn, Colusa, and Yolo counties, and was designed to convey agricultural return flows and storm runoff from the Colusa Basin to the Sacramento River at the Knights Landing Outfall Gates at Sacramento RM 34.15. The Colusa Basin includes 32 intermittent streams in the Coast Range Foothills including Funks and Stone Corral creeks.

Aluminum levels in the CBD at Gunners Field station frequently exceeded criteria for the protection of aquatic life, but usually met drinking water and agricultural goals. Similar to all currently monitored sampling sites, arsenic exceeded human toxicity criteria in all samples analyzed from the CBD, and cadmium levels rarely exceeded human toxicity standards. Total iron levels in the CBD frequently exceeded aquatic life and drinking water criteria, with less frequent exceedances of the agricultural goal. Dissolved iron levels occasionally exceeded the level established in the Central Valley Basin Plan during high flows caused by storm runoff. Manganese levels frequently exceeded aquatic life and agricultural goals, as well as drinking water standards to a lesser extent. Total recoverable lead levels analyzed by DWR were found to rarely exceed criteria except for the Public Health Goal, which was exceeded in the CBD. All samples contained total phosphorus at levels at or above the recommended criteria range to prevent nuisance algal growth in streams.

Sacramento River Opposite Moulton Weir

DWR monitored water quality at the Sacramento River Opposite Moulton Weir station from 2000 to 2010. Total aluminum levels in the Sacramento River at this location frequently exceeded aquatic life criteria during associated high flow conditions in the river, but rarely exceeded drinking water criteria and the agricultural goal. Arsenic levels exceeded human toxicity thresholds in all samples collected, and the criterion for protection of aquatic life for cadmium was occasionally exceeded. Copper levels frequently exceeded hardness-dependent aquatic life protection criteria during high flow conditions in the river, and iron levels frequently exceeded drinking water and aquatic life protection criteria, as well as the agricultural goal during the same river conditions. Dissolved iron levels exceeded the Central Valley Basin Plan level occasionally. Mercury levels approached, but did not exceed, the CTR criterion during the highest flows in the river. Manganese levels occasionally exceeded drinking water standards and the agricultural goal, and lead levels rarely exceeded drinking water criteria. All samples contained total phosphorus at levels at or above the recommended criteria range to prevent nuisance algal growth in streams.

7.3 Environmental Consequences

7.3.1 Regulatory Setting

Water quality is regulated at the federal and State levels. Provided below is a list of the applicable regulations. These regulations are discussed in detail in Chapter 4 Environmental Compliance and Permit Summary of this EIR/EIS.

7.3.1.1 *Federal Plans, Policies, and Regulations*

- Clean Water Act
  - Section 303(d) – Total Maximum Daily Load
  - Section 402 – National Pollutant Discharge Elimination System (NPDES) Permit Compliance
  - Section 404 – Discharge of Dredged or Fill Material
- Rivers and Harbors Act Section 10
- Federal Antidegradation Policy
- Federal Safe Drinking Water Act
- Federal Surface Water Treatment Rule
- National Toxics Rule
- Long-Term Management Strategy for the placement of Dredged Material in the San Francisco Bay Region
- Disinfectant and Disinfection Byproducts Rule
- Comprehensive Environmental Response, Compensation and Liability ActFederal Insecticide, Fungicide, and Rodenticide Act and Federal Environmental Pesticide Control Act
- Federal Environmental Protection Agency Ambient Water Quality Criteria Recommendations for Rivers and Streams in Nutrient Ecoregion I

7.3.1.2 *State Plans, Policies, and Regulations*

- Porter-Cologne Water Quality Act
- State Water Resources Control Board Decision 1641 (D-1641)
- Water Quality Control Plan for the Sacramento/San Joaquin River Basins
- San Francisco Bay Basin Water Quality Control Plan
- California Water Code Section 13160
- State Water Resources Control Board Water Rights Decisions, Water Quality Control Plans, and Water Quality Objectives
- California Antidegradation Policy
- Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary
- Water Quality Control Plan for the North Coast
- Water Quality Control Plan for the Tulare Basin
- Central Valley RWQCB Drinking Water Policy
- California Toxics Rule
- California Safe Drinking Water Act

7.3.2 Evaluation Criteria and Significance Thresholds

Significance criteria represent the thresholds that were used to identify whether an impact would be significant. Appendix G of the *CEQA Guidelines* suggests the following evaluation criteria for water quality:

Would the Project:

- Violate any water quality standards or waste discharge requirements?
- Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?
- Otherwise substantially degrade water quality?

The evaluation criteria used for this impact analysis represent a combination of the Appendix G criteria and professional judgment that considers current regulations, standards, and/or consultation with agencies, knowledge of the area, and the context and intensity of the environmental effects, as required pursuant to NEPA. For the purposes of this analysis, an alternative would result in a significant impact if it would result in any of the following:

- A violation of any water quality standard or waste discharge requirement, a change in water quality resulting in adverse effects to designated beneficial uses, or otherwise substantially degrade water quality
- A violation of any regulatory temperature criteria or temperature targets

Specifically, the following thresholds were used in the impact evaluation based on the requirements specified in the fourth edition of the water quality control plan (Central Valley Basin Plan) for the Sacramento River and San Joaquin River basins (CVRWQCB, 2011):

- EC threshold of 700 µmhos/cm for agricultural water quality and 900 µmhos/cm for drinking water quality for Extended Study Area service area deliveries
- EC threshold of 230 micromhos/cm (50 percentile) or 235 micromhos/cm (90 percentile) for the Sacramento River upstream of Knights Landing
- EC threshold of 240 micromhos/cm (50 percentile) or 340 micromhos/cm (90 percentile) for the Sacramento River upstream of the I Street Bridge
- Temperature threshold of 56°F in the Sacramento River reach from Keswick Dam to Hamilton City, during periods when temperature increases would be detrimental to the fishery. For the purpose of this analysis, this period was assumed to be from July 1st through November 30th, which is the period of salmonid upstream migration and spawning.
- Temperature threshold of 68°F in the Sacramento River reach from Hamilton City to the I Street Bridge.
- The CVP Operations Criteria and Plan (CVP OCAP) maximum temperature target, as measured at Watt Avenue, of 65°F from July 1st through September 30th (Reclamation 2009).
- A temperature increase of COLD or WARM intrastate waters more than 5°F above natural receiving waters.
- Specific Feather River temperature targets established in a 1983 DFG Agreement to protect the different lifestages of salmonids as measured at the Feather River Fish Hatchery (Fish Barrier Dam):
  - September 1 to September 30 56°F
  - October 1 to May 31 55°F
  - June 1 to August 31 60°F

Impacts to water quality in the Delta are considered significant or potentially significant if they increase salinity, when compared to Existing Conditions to a point that levels would violate D-1641 standards. D-1641 standards specify that salinity shall be controlled on the San Joaquin River at Vernalis to a 30-day mean EC mmhos/cm of 0.7 (700 µmhos/cm) for the irrigation season of April to August and 1.0 EC mmhos/cm (1,000 µmhos/cm) for the non-irrigation season of September to March. D-1641 standards also address the application of the salinity standard to additional downstream compliance locations beginning in April 2005 (Reclamation 2009). These standards are presented in Table 7-1.

Table 7-1
D-1641 EC Standards for the Delta

Water Year Type	Western Delta			
	Sacramento River @ Emmaton		San Joaquin River @ Jersey Point	
	EC 450 µmhos/cm from April 1st to Date Shown 14-Day Mean	EC Value from Date Shown to Aug 15th (µmhos/cm) 14-Day Mean	EC 450 µmhos/cm from April 1st to Date Shown* 14-Day Mean	EC Value from Date Shown to Aug 15th (µmhos/cm) 14-Day Mean
Wet	Aug 15	*	Aug 15	*
Above Normal	Jul 1	630	Aug 15	*
Below Normal	Jun 20	1,140	Jun 20	740
Dry	Jun15	1,670	Jun15	1,350
Critical	*	2,780	*	2,200

*When no date is shown, EC limit continues from April 1st.

If the monthly average X2[9] from implementation of an alternative would increase (i.e., X2 moves east/upstream from the Golden Gate Bridge) relative to the baseline, and would increase the frequency of a violation of the X2 water quality standard, it was considered to be a potentially significant impact. In this analysis, the changes in the monthly average X2 from implementation of an alternative are complex, and often result in improved X2 position and increased estuarine habitat. The potential impact of X2 on aquatic biological resources is addressed in Chapter 12 Aquatic Biological Resources.

Detailed evaluation of the implementation of an alternative was limited in the Suisun Bay, San Pablo Bay, and San Francisco Bay region. Therefore, as a conservative assumption, if the monthly average Delta outflow from implementation of an alternative would decrease by greater than five percent, it was considered to be a potentially significant impact.

7.3.3 Impact Assessment Assumptions and Methodology

7.3.3.1 *Assumptions*

The following assumptions were made regarding Project-related impacts (construction, operation, and maintenance impacts) to water quality:

- Direct Project-related construction, operation, and maintenance activities would occur in the Primary Study Area.
- Direct Project-related operational effects would occur in the Secondary Study Area.
- The only direct Project-related construction activity that would occur in the Secondary Study Area is the installation of an additional pump into an existing bay at the Red Bluff Pumping Plant.
- The only direct Project-related maintenance activity that would occur in the Secondary Study Area is the sediment removal and disposal at the two intake locations (i.e., GCID Canal Intake and Red Bluff Pumping Plant).

[9] Pursuant to D-1641, X2 is the location of the two parts per thousand salinity contour (isohaline), one meter off the bottom of the estuary, as measured in kilometers upstream from the Golden Gate Bridge. In the 1995 Bay-Delta Plan, an EC value of 2.64 mmhos/cm is used to represent the X2 location.

- No direct Project-related construction or maintenance activities would occur in the Extended Study Area.
- Direct Project-related operational effects that would occur in the Extended Study Area are related to San Luis Reservoir operation, increased reliability of water supply to agricultural, municipal, and industrial water users; and the provision of an alternate Level 4 wildlife refuge water supply. Indirect effects to the operation of certain facilities that are located in the Extended Study Area, and indirect effects to the consequent water deliveries made by those facilities, would occur as a result of implementing the alternatives.
- The existing bank protection located upstream of the proposed Delevan Pipeline Intake/Discharge facilities would continue to be maintained and remain functional.
- No additional channel stabilization, grade control measures, or dredging in the Sacramento River at or upstream of the Delevan Pipeline Intake or Discharge facilities would be required.
- All construction activities along the Sacramento River would be conducted during months when instream flows are managed outside of the flood season (e.g., June 15th to September 15th).
- The beneficial uses of the North Coast and Central Valley water bodies included in the Project are as follows: municipal and domestic supply (MUN), agricultural supply (AGR), industrial service supply (IND), industrial process supply (PRO), navigation (NAV), hydropower generation (POW), water contact recreation (REC-1), non-contact water recreation (REC-2), commercial and sport fishing (COMM), aquaculture (AQUA), warm freshwater habitat (WARM), cold freshwater habitat (COLD), estuarine habitat (EST), wildlife habitat (WILD), preservation of biological habitats of special significance (BIOL), migration of aquatic organisms (MIGR), spawning, reproduction, and/or early development (SPWN), and shellfish harvesting (SHELL). The Basin Plans also state that waterbodies within the basins that do not have beneficial uses designated are assigned MUN designations in accordance with the provisions of State Water Board Resolution No. 88-63.

7.3.3.2 *Methodology*

This section describes the approach used to evaluate the surface water quality impacts of the alternatives. Surface water quality was evaluated for the Extended, Secondary, and Primary study areas. Modeling was used to estimate the changes in surface water EC and temperature that would result from implementation of each alternative. EC was used as a surrogate for evaluating other water quality constituents that were not modeled. For the waterbodies where explicit EC or temperature estimates were unavailable, surface water quality impacts were assessed based on modeled changes in flow or storage conditions.

Impact Evaluation Approach

The Extended Study Area represents the regions south of the Delta where Delta exports are used for agricultural, municipal, industrial, and wildlife refuge water supply. The EC values for the Extended Study Area were determined based on the EC and volume of the exports at the Banks and Jones pumping plants. These EC values were estimated using the results from the DSM2 Delta Simulation Model (DSM2 QUAL). The monthly EC summary results at the Banks and Jones pumping plants for an alternative were compared with the appropriate baseline to determine the resulting change. If the monthly average EC was higher from an alternative, when compared to Existing Conditions, the increased level was evaluated against an applicable water quality standard to determine whether the increase in EC exceeded the standard.

The Secondary Study Area is comprised of the waterbodies that could be affected by Project operations. It includes the CVP and SWP storage and conveyance features, reaches of the rivers downstream of the CVP and SWP storage features, the Sacramento-San Joaquin Delta, and the bays. For the Sacramento River at the three potential intakes for Sites Reservoir, worst-case EC values were estimated based on the composition of the water present at the intakes. The origin of the water at each intake was traced to various contributing sources, and the worst-case EC at each intake was estimated based on the worst-case EC estimate of each of the sources, as explained in the EC Mass Balance approach. For the Sacramento-San Joaquin River Delta, the EC values were estimated using the results from the DSM2 QUAL model.

For the locations where EC results are available, monthly EC summary results for each alternative were compared with the appropriate baseline. EC results for the Secondary Study Area are available for the three intake locations along the Sacramento River and the various compliance locations in the Delta. If monthly average EC was found to be higher from an alternative, when compared to the baseline, it was evaluated against an available water quality standard to determine whether the increase in EC exceeded the standard. Impacts to the X2 position in the Delta were determined by comparing the monthly X2 position summary results from the CALSIM II model for each alternative with the appropriate baseline. Impacts to water temperature were determined using USRWQM and Reclamation Temperature Model results for the Trinity, Sacramento, Feather, and American rivers. Initially, the monthly average temperatures were compared for each alternative with the appropriate baseline. If the temperature was found to be higher from an alternative, when compared to the baseline, it was evaluated against an appropriate temperature threshold to determine whether the increase in temperature exceeded that threshold.

The Primary Study Area represents the area within which the Project storage and conveyance facilities would be constructed. The EC values within the Primary Study Area were determined based on the worst-case EC mass balance estimates (described below) at the three potential Sacramento River intakes. For impacts to Sacramento River temperatures downstream of the Delevan Pipeline Intake/Discharge Facilities that would result from Sites Reservoir releases, results from the preliminary Sites Reservoir temperature model were used.

Model results are presented by Water Year Type as defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB, 2006) for the full 82-year simulation period (water years 1922 through 2003). The different Water Year Types and the percentage of the 82-year simulation period that each type of water year occurred are listed below:

- Wet: 32 percent
- Above Normal: 15 percent
- Below Normal: 17 percent
- Dry: 22 percent
- Critical: 15 percent

EC Mass Balance Approach

Worst-case EC conditions were simulated to assess the maximum potential impact of Project implementation on Sacramento River EC. The analysis included estimation of the worst-case concentrations for various sources along the Sacramento River, as well as the estimation of source water contribution and worst-case concentrations at locations of interest along the Sacramento River. The analysis calculated a simple mass balance using the source concentrations and the percent of source volumes estimated, based on the daily results from USRDOM modeling. The analysis was limited to the three Project proposed intake locations along the Sacramento River (T-C Canal Intake, GCID Canal Intake, and the proposed Delevan Pipeline Intake). The Primary and Secondary study area analyses were formulated using the limited EC field measurements available for various tributaries (sources) and locations along the Sacramento River and assume worst-case EC conditions. The USRDOM model description and results are included in Appendix 6C. The EC Mass Balance Approach description and results are included in Appendix 7C.

DSM2 Delta Simulation Model and CALSIM II CVP and SWP Operations Model

DSM2 is a one-dimensional hydrodynamic and water quality simulation model used to simulate hydrodynamics and water quality in the Sacramento-San Joaquin Delta. DSM2 represents the best available planning model for Delta tidal hydrodynamics and salinity modeling. It is appropriate for describing the existing conditions in the Delta, as well as performing simulations for the assessment of incremental environmental impacts caused by changes in the facilities and operations. The DSM2 model has two separate components: HYDRO and QUAL. The HYDRO module is a one-dimensional, implicit, unsteady, open channel flow model that simulates flows, velocities, and water surface elevations. HYDRO provides the flow input for QUAL. The QUAL module is a one-dimensional water quality transport model that simulates fate and transport of water quality constituents, such as EC, given a flow field simulated by HYDRO. DSM2 QUAL provides EC estimates at various locations in the Sacramento-San Joaquin Delta, including at key salinity control points such as Emmaton, Jersey Point, and at the two export locations at the Banks Pumping Plant and the Jones Pumping Plant. The DSM2 model description and results are included in the Appendix 7D.

DSM2 does not provide all of the water quality information needed for this assessment. The CALSIM II model provides results for the X2 position. Figure 7-1 shows the locations of selected SWRCB D-1641 water compliance stations located in the Delta that were used in this evaluation, including the three stations for defining the X2 standard. Figure 7-1 also includes lines showing the potential range of the X2 location, from 66 km to 95 km from the Golden Gate Bridge, in increments of 5 km.

The X2 position is used along with DSM2 EC results for the assessment of changes in the Sacramento-San Joaquin Delta. The CALSIM II model description and results are included in Appendix 6B. The model results for the X2 position are included in Appendix 6B.

USRWQM and Reclamation Temperature Model

Water temperatures were modeled for major rivers in the Secondary Study Areas to evaluate the thermal impacts of Project operations using the Upper Sacramento River Water Quality Model (USRWQM) and the Reclamation Temperature Model.

USRWQM was developed using the HEC-5Q model to simulate mean daily (using six-hour meteorology) reservoir and river temperatures at Shasta, Trinity, Lewiston, Whiskeytown, Keswick, and Black Butte reservoirs, and the Trinity River, Clear Creek, the upper Sacramento River from Shasta to Knights Landing, and Stony Creek. USRWQM is designed for long-term planning simulations of temperature variability in these the reservoirs and streams, given CVP/SWP Project operations, and allows comparison between existing and assumed future scenarios. Daily flows, simulated in the USRDOM model for an 82-year period (water years 1922 to 2003), are used as input to the USRWQM.

The Reclamation Temperature Model is a reservoir and stream temperature model, which simulates monthly reservoir and stream temperatures used for evaluating the effects of CVP/SWP Project operations on mean monthly water temperatures in the basin. The model simulates temperatures in five major reservoirs (Trinity, Whiskeytown, Shasta, Oroville, and Folsom), four downstream regulating reservoirs (Lewiston, Keswick, Thermalito, and Natoma), and four main river systems (Trinity, Sacramento, lower Feather, and lower American). The reservoir component of the Reclamation Temperature Model calculates temperature changes in main and regulating reservoirs. Using regulating reservoir release temperature as the initial river temperature, the river model computes temperatures at several locations along the rivers. The calculation points for river temperatures generally coincide with tributary inflow locations.

The modeled temperatures used to represent waters in the Secondary Study Area include temperatures from three locations on both the Trinity River and Clear Creek, eight locations on the Sacramento River from Keswick to Freeport, and three locations in both the Feather and Lower American rivers. Sacramento River locations modeled for the Primary Study Area include at Red Bluff, downstream of Red Bluff, downstream of Hamilton City, at Delevan, and downstream of Delevan.

For the Trinity River and Upper Sacramento River locations, where results were available from both the USRWQM and the Reclamation Temperature Model, the results from the USRWQM model were used.

The USRDOM model description and results are included in Appendix 6C. The USRWQM and the Reclamation Temperature Model descriptions and results are included in Appendix 7E.

Sites Reservoir Discharge Temperature Model

- A preliminary Sites Reservoir Discharge Temperature Model was drafted for the temperature analysis of the proposed Sites Reservoir. Only Alternative C was evaluated, based on the assumption that it is the alternative that would result in the worst-case impact to the Sacramento River temperature conditions downstream of the proposed Delevan Pipeline Intake/ Discharge facilities. Therefore, the results from the analysis of Alternative C were assumed to be applicable to the other two action alternatives.

- The physical characteristics and the daily operations of Sites Reservoir, as proposed for Alternative C, were derived from the Alternative C USRDOM simulation. Sites Reservoir inflow temperatures and the Sacramento River temperature targets were derived using the results from the Alternative C USRWQM simulation. Inflow to Sites Reservoir was assumed to be the daily flow from the Holthouse Reservoir Complex to Sites Reservoir, and outflow from Sites Reservoir was specified using daily flow from Sites Reservoir to the Holthouse Reservoir Complex, as simulated in the USRDOM model. Using the information from the USRDOM model ensured that the daily Sites Reservoir operations in the preliminary Sites Reservoir Temperature Model were consistent with the resulting operations from USRDOM and CALSIM II models for Alternative C. Sacramento River temperatures for the location upstream from the proposed Delevan Pipeline Intake/ Discharge facilities were blended with simulated Sites Reservoir release temperatures. The blended temperature was then used to determine whether Sacramento River temperatures would be affected by Sites Reservoir releases. A limitation to this model output is that the potential warming effects from the Project conveyance facilities were not taken into account while computing inflow or release temperatures. However, significant warming is not expected within an underground pipeline.

- The USRDOM model description and results are included in Appendix 6C. The USRWQM and the Reclamation Temperature Model descriptions and results are included in Appendix 7E. The Sites Reservoir Discharge Temperature Model description and results are included in Appendix 7F.

7.3.4 Topics Eliminated from Further Analytical Consideration

Water temperature impacts (Impact SW Qual-2) were not specifically evaluated for agricultural, municipal, industrial, or wildlife refuge water supply within the Extended Study Area, or for San Luis Reservoir and its service areas, because there are no applicable temperature criteria for these beneficial uses.

The following facilities within the Primary Study Area would not store or release water and do not have waterbodies located within their facility footprints; their construction, operation, and maintenance activities would, therefore, have no impact on water temperature (**Impact SW Qual-2**) and are not discussed further: Recreation Areas, Road Relocations and South Bridge, Sites Electrical Switchyard, Field Office Maintenance Yard, Delevan Pipeline Electrical Switchyard, TRR Electrical Switchyard, TRR Pipeline Road, Holthouse Reservoir Electrical Switchyard, Delevan Transmission Line, and the Project Buffer.

7.3.5 Impacts Associated with the No Project/No Action Alternative

7.3.5.1 *Extended Study Area – No Project/No Action Alternative*

Construction, Operation, and Maintenance Impacts

Agricultural, Municipal, Industrial, and Wildlife Refuge *Water Use*

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

The No Project/No Action Alternative includes implementation of projects and programs being constructed, or those that have gained approval, as of June 2009. A comparison of the modeled long-term average EC levels for the No Project/No Action Alternative and Existing Conditions at Clifton Court Forebay indicates that EC levels are expected to decrease (improve) or remain similar in all months. A negligible increase of 0.2 percent in long-term average EC levels is expected to occur in September. Comparing water year type averages, EC levels for the No Project/No Action Alternative are expected to decrease or remain similar to Existing Conditions in most months. Average EC levels for the No Project/No Action Alternative are expected to increase slightly in September during Wet and Above Normal water years (2.6 percent and 1.4 percent, respectively); in September and October during Below Normal water years (1.2 percent and 1.7 percent, respectively); and in July, August, and October in Critical water years (negligible increases). However, these modeled average EC levels are well below the Agricultural Water Quality Goal (Ag Goal) of 700 µmhos/cm, which is protective of various agricultural water uses, including crop irrigation and stock watering (CVRWQCB, 2011). As such, the drinking water goal of 900 µmhos/cm to protect human health would not be exceeded.

Similarly, long-term average EC levels for the No Project/No Action Alternative, when compared to Existing Conditions at the Jones Pumping Plant, are expected to decrease during all months. Water year type averages are expected to decrease or remain similar, with negligible increases expected during a few months of some water year types. Implementation of the No Project/No Action Alternative is expected to reduce the long-term average export-weighted EC, TDS, chloride, and bromide concentrations, when compared to Existing Conditions. Similarly, the Dry and Critical water year type average export-weighted concentrations for the No Project/No Action Alternative would be reduced.

During November, December, and January of Critical water years at Clifton Court Forebay, and during November through March of Critical water years at the Jones Pumping Plant, average EC levels are expected to exceed the Ag Goal. However, the average EC levels associated with Existing Conditions already exceed the goal, and implementation of the No Project/No Action Alternative would decrease those levels. Therefore, implementation of the No Project/No Action Alternative **would not have a substantial adverse effect** on EC levels, TDS, bromide, and chloride concentrations associated with agricultural, municipal, industrial, and wildlife refuge water supply.

Central Valley Basin Plan EC criteria only apply to agricultural and drinking water supplies. Other water quality parameters, such as metals and nutrients, were not modeled as part of this analysis. The potential changes to the concentrations of these constituents are unknown at this time. However, the improvements in EC levels for the No Project/No Action Alternative, when compared to Existing Conditions, are expected to translate into improvements of the concentrations of these constituents. Therefore, implementation of the No Project/No Action Alternative, when compared to Existing Conditions, **would not have a substantial adverse effect** on the concentrations of nutrients, metals, and other water quality constituents (including mercury) associated with agricultural, municipal, industrial, and wildlife refuge water supply.

Regardless of the predicted changes in surface water quality within the Extended Study Area as a result of implementing the No Project/No Action Alternative, the impacts of the projects included in the No Project/No Action Alternative have already been evaluated on a project-by-project basis, pursuant to CEQA and/or NEPA, and their potential for impacts to surface water quality have been addressed in those environmental documents.

Population growth is expected to occur in California throughout the period of Project analysis (i.e., 100 years), and is included in the assumptions for the No Project/No Action Alternative. A larger population could be expected to adversely impact surface water quality. However, plans for population growth in General Plans would be subject to their own environmental reviews. Therefore, population growth associated with implementation of the No Project/No Action Alternative **would not have a substantial adverse effect** on surface water quality.

San Luis Reservoir

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Reservoir surface water level fluctuations can exacerbate nuisance algae blooms when reservoir levels are low due to increased nutrient concentration, reduced reservoir mixing, and higher water temperatures during low storage conditions. With implementation of the No Project/No Action Alternative, San Luis Reservoir would continue to experience water level fluctuations as in the past. Modeled end-of-month long-term average surface water elevations for the No Project/No Action Alternative, when compared to Existing Conditions, indicate slight decreases in elevation during all months. These decreases in surface water elevation fall within the historic range of operation for San Luis Reservoir.

A comparison of water year type averages indicates an increase in elevation of up to 16 feet during April through December in Critical water years and up to 12 feet during April through June in Dry water years resulting from a reduction in South of Delta allocations. Elevations would, therefore, be improved during periods in which algae blooms are a concern. San Luis Reservoir typically experiences dissolved oxygen and algae concerns when storage levels falls below 250,000 acre-feet. End-of-month storage exceedance plots indicate that San Luis Reservoir would have storage levels greater than 250,000 acre-feet during December through May 100 percent of the time for both the No Project/No Action Alternative and Existing Conditions. During June through November, the No Project/No Action Alternative would perform similarly to Existing Conditions. The greatest difference would occur in August, when Existing Conditions would exceed a storage level of 250,000 acre-feet approximately 80.2 percent of the water years, and the No Project/No Action Alternative would exceed the low level approximately 84 percent of the water years. Therefore, water level and storage fluctuations associated with the No Project/No Action Alternative **would not have a substantial adverse effect** on nuisance algae blooms in San Luis Reservoir, when compared to Existing Conditions.

Water quality conditions in San Luis Reservoir depend on Delta exports from the Banks and Jones pumping plants. Refer to the **Impact SW Qual-1** discussion for Agricultural, Municipal, Industrial, and Wildlife Refuge Water Use; it is directly applicable to San Luis Reservoir. Implementation of the No Project/No Action Alternative, when compared to Existing Conditions, **would not have a substantial adverse effect** on EC levels, TDS, bromide and chloride concentrations, metals, nutrients, and other water quality constituents in the San Luis Reservoir.

7.3.5.2 *Secondary Study Area – No Project/No Action Alternative*

<u>Construction, Operation, and Maintenance Impacts</u>

Trinity Lake, Lewiston Lake, Trinity River, Klamath River downstream from Trinity River, Whiskeytown Lake, Spring Creek, Keswick Reservoir, and Clear Creek -

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Changes in water quality within the Trinity River Basin associated with implementation of the No Project/No Action Alternative, when compared to Existing Conditions, are expected to be negligible and entirely consistent with flow requirements in the Trinity Record of Decision (refer to Section 6.2.2.3 in Chapter 6 Surface Water Resources). Implementation of the No Project/No Action Alternative would result in similar storage conditions in Trinity Lake. Similar storage conditions would not be expected to adversely affect water quality. Consequently, releases from Trinity Lake to the Trinity River would not be expected to adversely impact water quality, and flows from the Trinity River into the Klamath River would not be expected to adversely impact water quality.

With implementation of the No Project/No Action Alternative, Lewiston Lake and Whiskeytown Lake would continue to operate as regulating reservoirs within their historical operational range and would not be expected to adversely impact water quality. Consequently, Whiskeytown Lake releases to Clear Creek would not be expected to adversely impact water quality in Clear Creek. Spring Creek and Keswick Reservoir would also continue to operate within their historical operational range.

Continued operations within the historical range of operation associated with implementation of the No Project/No Action Alternative, when compared to Existing Conditions, **would, therefore, not have a substantial adverse effect** on water quality in these waterbodies.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Trinity Lake and Lewiston Lake control releases to the Trinity River. Modeling results indicate that implementation of the No Project/No Action Alternative, when compared to Existing Conditions, would result in either negligible changes or no change to average monthly Trinity River water temperatures at the Trinity River at North Fork, Trinity River at Douglas City, and Trinity River downstream of Lewiston Dam locations. Consequently, flows from the Trinity River into the Klamath River would be expected to result in negligible changes or no change to Klamath River average monthly water temperatures.

Whiskeytown Lake regulates releases into Clear Creek. Modeling results indicate similar negligible changes to average monthly Clear Creek water temperatures for the Clear Creek at Igo, Clear Creek at Mouth, and Clear Creek downstream of Whiskeytown locations, when compared to Existing Conditions. In addition, Keswick Reservoir would continue to operate as a regulating reservoir. Consequently, flows from Clear Creek and Keswick Reservoir into Spring Creek would be expected to result in negligible changes or no change to Spring Creek average monthly water temperatures.

Therefore, implementation of the No Project/No Action Alternative, when compared to Existing Conditions, **would not have a substantial adverse effect** on water temperatures in Trinity Lake, Lewiston Lake, Trinity River, Klamath River downstream from Trinity River, Whiskeytown Lake, Spring Creek, and Clear Creek.

Shasta Lake

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Water quality conditions within the Shasta Lake basin associated with the No Project/No Action Alternative are expected to be similar to Existing Conditions. Sediment and heavy metal runoff during rain events would continue to impact water quality due to local geology, mining history, and timber harvest land uses. In addition, sediment and nutrient impacts from the Pit River input to the reservoir due to agricultural runoff would continue to occur.

Modeling results indicate that implementation of the No Project/No Action Alternative would result in negligible changes to average end-of-month surface water elevation at Shasta Lake during all months of all water year types, when compared to Existing Conditions. These negligible changes to surface water elevations would not be expected to adversely impact water quality.

Other water quality constituents of concern, including mercury and unknown toxicity on the 303(d) list of impaired waters, were not evaluated explicitly. However, modeling results indicate that implementation of the No Project/No Action Alternative would also result in negligible changes to Shasta Lake average end-of-month storage conditions during all months of all water year types. These negligible changes would not be expected to adversely impact these water quality constituents.

Keswick Reservoir water quality is determined by releases from Shasta Lake. Therefore, implementation of the No Project/No Action Alternative, when compared to Existing Conditions, **would not have a substantial adverse effect** on Shasta Lake and Keswick Reservoir water quality.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Refer to the **Impact SW Qual-1** discussion related to storage conditions. Slight changes to average end-of-month storage would not be expected to result in adverse impacts to water temperature. In addition, modeling results for releases to the Sacramento River downstream of Keswick indicate negligible changes to long-term average monthly temperatures in all months, and negligible changes to average monthly temperature during all months of all water year types.The greatest average change would occur during September of Critical water years, in which temperatures are expected to decrease by 0.6 degree. Therefore, implementation of the No Project/No Action Alternative, when compared to Existing Conditions, **would not have a substantial adverse effect** on Shasta Lake and Keswick Reservoir water temperature.

Sacramento River

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Looking at worst-case EC for the Keswick to Red Bluff reach of the Sacramento River, modeling results for the T-C Canal Intake for the No Project/No Action Alternative indicate that long-term monthly average EC levels are expected to increase slightly during all months, when compared to Existing Conditions, with the greatest increase of 0.8 percent occurring in November. Modeling results indicate that monthly average EC levels by water year type would increase in all months of all water year types, with the exception of negligible decreases in February of Below Normal water years and March of Dry water years. The largest increases of 1.2 percent would occur in November of Dry water years.

Worst-case EC modeling results for the Red Bluff to Hamilton City reach of the Sacramento River, estimated at the GCID Canal Intake, indicate similar results for the No Project/No Action Alternative because slight increases are expected in all months for the long-term average monthly EC, when compared to Existing Conditions, and the greatest increase (0.8 percent) would occur in November. Modeling results for monthly average EC by water year type are also similar, with the greatest increase (1.1 percent) expected to occur in November of Dry water years.

For the GCID Canal Intake to the Delevan Pipeline Intake reach of the Sacramento River, estimated at the Delevan Pipeline, worst-case EC modeling results for the No Project/No Action Alternative show similar trends to the upstream reaches because slight increases in long-term monthly average EC levels are expected during most months, and negligible decreases are expected during February, July, and August, when compared to Existing Conditions. The greatest increase (0.9 percent) is expected to occur in November. Modeling indicates results for monthly average EC by water year type that would be similar, with the greatest increase of 1.2 percent expected to occur in November. Modeling results for worst-case EC levels for the Sacramento River downstream of the Delevan Pipeline are expected to be similar.

Worst-case EC levels for the CBD to the entrance of the Delta at the I Street Bridge reach of the Sacramento River were not estimated explicitly. However, the changes in the EC levels in this reach are expected to trend consistently with the changes described for the upper Sacramento River reaches.

The water year type averages of the worst-case EC values for the No Project/No Action Alternative, in all months, are expected to be below the Central Valley Basin Plan requirement of 230 µmhos/cm for the Sacramento River reach upstream of the CBD. Therefore, these negligible to minor increases in worst-case EC levels on the Sacramento River resulting from implementation of the No Project/No Action Alternative **would not have a substantial adverse effect**, when compared to Existing Conditions.

Other water quality constituents of concern, including mercury and unknown toxicity on the 303(d) list of impaired waters, were not evaluated explicitly. Water quality in the upper reach of the Sacramento River would continue to be generally good. Stormwater-driven runoff would continue to cause occasional elevated levels of mercury, other trace metals, pesticides, and turbidity that would adversely affect water quality in this reach. Water quality in the lower reach of the Sacramento River is expected to be similar to Existing Conditions. Elevated levels of metals and pesticides, turbidity, and pesticide and metal bioaccumulation in fish caused primarily by agriculture return flows from CBD releases near Knights Landing are expected to continue to adversely affect water quality in this reach. However, the changes in the concentrations of the other water quality constituents are expected to be proportional to the changes in the worst-case EC levels for the No Project/No Action Alternative. Therefore, implementation of the No Project/No Action Alternative **would not have a substantial adverse effect** on water quality constituents in the Sacramento River, when compared to the Existing Conditions.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Modeling results for the No Project/No Action Alternative indicate negligible changes to long-term average monthly temperatures in all months, and to monthly average temperature during all months of all water year types, for each of the following Sacramento River locations, when compared to Existing Conditions: downstream of Keswick, at Balls Ferry, at Jellys Ferry, at Bend Bridge, at Red Bluff, downstream of Red Bluff, downstream of Hamilton City, at Delevan, downstream of Delevan, and at Knights Landing.

Modeled average monthly temperatures by water year type for the No Project/No Action Alternative indicate that the 56°F criterion for July through October would be exceeded at the following locations on the Sacramento River: downstream of Keswick from August through October in Critical water years; at Balls Ferry from July through October in Critical water years and September in Dry water years; at Jellys Ferry in September in Above Normal, Below Normal, and Dry water years, as well as from July through October in Critical water years; and at Bend Bridge from July through August in Wet water years, August and September in Above Normal, Below Normal, and Dry water years, and July through October in Critical water years.

Modeled average monthly temperatures by water year type for the No Project/No Action Alternative also indicate that the 68°F criterion for July through November would be exceeded at the following Sacramento River locations: at Knights Landing during July and August of all water year types; at Feather River and at American River during July and August in Wet water years, and July through September in Below Normal, Dry, and Critical water years.

Although these criteria temperatures would be exceeded, it is important to note that the criteria temperatures are already exceeded during Existing Conditions at these locations, and implementation of the No Project/No Action Alternative would result in either the same or decreased (improved) temperatures. In some locations during some months, modeling results indicate that the No Project/No Action Alternative could result in increased temperatures, but the expected increase of less than one percent falls within the “noise” of the model and is not considered significant. Therefore, implementation of the No Project/No Action Alternative, when compared to Existing Conditions, **would not have a substantial adverse effect** on Sacramento River water temperatures.

Lake Oroville, Thermalito Complex, and the Feather River

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Modeling results indicate that implementation of the No Project/No Action Alternative would result in decreased long-term average end-of-month storage conditions at Lake Oroville during all months, when compared to Existing Conditions, with the greatest decrease of 2.8 percent expected to occur in September. Modeling results for average end-of-month storage by water year type indicate decreases in all months of all water year types, with the exception of negligible increases of up to 0.4 percent expected in October and November of Dry water years, and July of Critical water years. These slight decreases in storage conditions would not be expected to have a substantial adverse effect on the water quality of Lake Oroville. The Thermalito Complex would continue to operate as a regulating reservoir system within the historical operational range. Consequently, releases from Lake Oroville and the Thermalito Complex would not be expected to have a substantial adverse effect on the water quality of the Feather River.

Therefore, with implementation of the No Project/No Action Alternative, water quality in the Feather River is expected to continue to be generally good. Some metals and turbidity levels are expected to continue to occasionally exceed Central Valley Basin Plan criteria, mainly during periods of stormwater-driven runoff. Elevated pathogen levels are expected to continue, primarily during the contact recreation season at developed recreation areas. Therefore, water quality impacts to Lake Oroville, the Thermalito Complex, and the Feather River resulting from implementation of the No Project/No Action Alternative **would not have a substantial adverse effect**, when compared to Existing Conditions**.**

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Refer to the **Impact SW Qual-1** discussion. Slight decreases in storage conditions at Lake Oroville, and continued operation of the Thermalito Complex as a regulating reservoir system, would not be expected to result in a substantial adverse effect to their water temperatures. In addition, modeling results for long-term average monthly water temperatures and monthly average temperatures by water year type for the Feather River downstream of the Fish Barrier Dam, downstream of Thermalito Afterbay, and at the mouth indicate that implementation of the No Project/No Action Alternative would result in negligible changes, when compared to Existing Conditions. In addition, models indicate that water temperatures at all three Feather River locations would meet the basic Central Valley Basin Plan temperature criteria.

Specific Oroville Facilities temperature targets for the Feather River Fish Hatchery would be exceeded during one or more months in all but Above Normal water year types. Although these criteria temperatures would be exceeded, it is important to note that the criteria are already exceeded during Existing Conditions during these months, and implementation of the No Project/No Action Alternative would result in either the same or decreased temperatures. Therefore, implementation of the No Project/No Action Alternative, when compared to Existing Conditions, **would not have a substantial adverse effect** on Lake Oroville, Thermalito Complex, and Feather River water temperatures.

Sutter Bypass and Yolo Bypass

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

The changes in water quality in the Sutter Bypass and Yolo Bypass were not modeled. However, the changes in the flow spills and flows into these bypasses, respectively, were modeled.

Spills into the Sutter Bypass were modeled at Ord Ferry, Moulton Weir, Colusa Weir, and Tisdale Weir. The modeling of spills was performed at a daily timestep using the USRDOM model. Monthly average exceedance probability plots indicate that spills for the No Project/No Action Alternative would be the same or similar in magnitude and frequency to spills for Existing Conditions at Ord Ferry, Moulton Weir, Colusa Weir and Tisdale Weir.

Spills into the Sutter Bypass from the Sacramento River represent only some of the hydrologic inputs to the lower Sutter Bypass. Large reductions in spill flows can potentially affect the available dilution flows for various water quality constituents. The relationships and interactions of the various hydrologic inputs into the Sutter Bypass and the resulting flow and flooded area in the Sutter Bypass were not modeled. It is not anticipated that the changes in spill exceedance probabilities discussed above would have a substantial impact on surface water quality in the Sutter Bypass. Therefore, it is concluded that the implementation of the No Project/No Action Alternative **would not have a substantial adverse effect** on surface water quality, when compared to Existing Conditions.

Spills into the Yolo Bypass at Fremont Weir and Sacramento Weir and resultant flows from the Yolo Bypass into the Sacramento-San Joaquin Delta were modeled at a daily timestep using a specialized module built into the CALSIM II model. Monthly average exceedance probability plots indicate that Yolo Bypass flows for the No Project/No Action Alternative would be the same or similar in magnitude and frequency to flows for Existing Conditions.

It is not anticipated that the described changes in Yolo Bypass flows and outflow would have a substantial impact on surface water quality. Therefore, implementation of the No Project/No Action Alternative **would not have a substantial adverse effect** on Yolo Bypass water quality, when compared to Existing Conditions.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Water temperature modeling was not performed for the Sutter Bypass and the Yolo Bypass. However, as described above, the expected changes in spills to the Sutter Bypass represent only a portion of the input to the bypass, and flows into and out of the Yolo Bypass are expected to remain similar. Therefore, it is expected that implementation of the No Project/No Action Alternative **would not have a substantial adverse effect** on water temperature in the Sutter Bypass and Yolo Bypass, when compared to Existing Conditions.

Folsom Lake, Lake Natoma, and the American River

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Modeled end-of-month storage conditions for the No Project/No Action Alternative for Folsom Lake indicate minor decreases to long-term averages in all months, with the exception of a negligible increase in March, when compared to Existing Conditions. Modeling results for average end-of-month storage by water year type indicate similar minor changes, with the exception of a 6.2 percent decrease in August of Below Normal water years. These slight decreases in storage conditions would not be expected to have a substantial adverse effect on the water quality of Folsom Lake. Lake Natoma would continue to operate as a regulating reservoir system within the historical operational range. Consequently, releases from Folsom Lake and Lake Natoma would not be expected to have a substantial adverse effect on the water quality of the American River.

Therefore, with implementation of the No Project/No Action Alternative, water quality in the American River is expected to continue to be generally good. Elevated levels of pathogens and nutrients would still occur during periods of stormwater-driven urban runoff. Depressed dissolved oxygen levels, pH, and taste and odor issues would continue to occur occasionally during the warm summer months. Permitted municipal and industrial discharges could also affect water quality in the river. Therefore, water quality impacts to Folsom Lake, Lake Natoma, and the American River resulting from implementation of the No Project/No Action Alternative, when compared to Existing Conditions, **would not have a substantial adverse effect.**

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Refer to the **Impact SW Qual-1** discussion. Minor decreases to average end-of-month storage conditions at Folsom Lake, and continued operation of Lake Natoma as a regulating reservoir system, associated with implementation of the No Project/No Action Alternative, when compared to Existing Conditions, **would not have a substantial adverse effect** on their water temperatures.

Modeling results for average monthly water temperatures by water year type for the American River downstream of Nimbus Dam, at Watt Avenue, and at the mouth indicate that implementation of the No Project/No Action Alternative, when compared to Existing Conditions, would result in negligible decreases in some months, and minor increases of one degree or less in most months of all water year types.

However, modeling results also indicate that the OCAP temperature target at Watt Avenue would be exceeded during July through September in all but Above Normal water year types. This temperature target is already exceeded during Existing Conditions, but implementation of the No Project/No Action Alternative would increase temperatures by up to 0.9 degree, when compared to Existing Conditions. Exceedance plots indicated that the temperature criteria would be exceeded 100 percent of the years in July and August for both the No Project/No Action Alternative and Existing Conditions, but in September would be exceeded in approximately 91.3 percent of the years during Existing Conditions, and approximately 97.5 percent of the years if the No Project/No Action Alternative is implemented. Therefore, implementation of the No Project/No Action Alternative, when compared to Existing Conditions, **would have a potentially substantial adverse effect** on American River water temperatures.

Sacramento-San Joaquin Delta

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Modeled long-term average monthly EC results for the Sacramento River at Emmaton compliance location indicate that implementation of the No Project/No Action Alternative, when compared to Existing Conditions, would result in minor changes in average monthly EC during March through November, and moderate decreases during January and February. Modeled average monthly EC results indicate minor changes during all months of Wet and Above Normal water years. Below Normal, Dry, and Critical water years would also experience minor changes in average monthly EC during most months, with the exception of moderate decreases in January and July of Below Normal water years, and January and February of Critical water years. A moderate increase (7.5 percent) is expected to occur in August of Dry water years. Based on these expected monthly averages, D-1641 salinity targets may not be met at this compliance location during August in Wet and Above Normal water years, and during June and August in Dry water years. These salinity targets would already be exceeded during Existing Conditions, and during two of these months, implementation of the No Project/No Action Alternative would reduce the average EC levels. However, average EC levels may be increased above Existing Conditions levels during August in Wet and Dry water years.

To further determine if the increases in average EC levels associated with implementation of the No Project/No Action Alternative during August in Wet and Dry water years would impact compliance with D-1641 salinity standards, exceedance probabilities were examined and compared to those of Existing Conditions. The exceedance plots show that the No Project/No Action Alternative and Existing Conditions would perform similarly because results for both indicate that monthly average EC in August would exceed the 450 µmhos/cm Wet water year standard approximately 96 percent of the years. However, monthly Average EC in August would exceed the 1,670 µmhos/cm Dry water year standard approximately 17 percent of the years with implementation of the No Project/No Action Alternative, and the 1,670 µmhos/cm standard would be exceeded approximately 13 percent of the years during Existing Conditions. Therefore, implementation of the No Project/No Action Alternative **would have a potentially substantial adverse effect** on average monthly EC levels in the Delta due to changes at the Sacramento River at Emmaton compliance location.

Modeled long-term average monthly EC results for the San Joaquin River at Jersey Point compliance location indicate that implementation of the No Project/No Action Alternative, when compared to Existing Conditions, would result in decreases of up to 6.2 percent in average monthly EC levels during all months. Modeled average monthly EC results indicate minor increases from August through December in Wet and Above Normal water years, in September and October in Below Normal water years, and in April through June in Critical water years. Based on these expected monthly averages, D-1641 salinity targets may not be met at this compliance location during August in Wet, Above Normal, and Dry water years; and during July and August in Below Normal water years. These salinity targets are also exceeded during Existing Conditions, and during several of these months, implementation of the No Project/No Action Alternative would reduce EC levels. However, EC levels would be increased above Existing Conditions levels during August in Wet and Above Normal water years.

To further determine if the increases in average EC levels associated with implementation of the No Project/No Action Alternative during August in Wet and Above Normal water years would impact compliance with D-1641 salinity standards, exceedance probabilities were examined and compared to those of Existing Conditions. The exceedance plots show that the No Project/No Action Alternative and Existing Conditions would perform similarly because results for both indicate that monthly average EC in August would exceed the 450 µmhos/cm Wet and Above Normal water year standard in approximately 96 percent of the years. Therefore, implementation of the No Project/No Action Alternative **would not have a substantial adverse effect** on average monthly EC levels in the Delta due to changes at the San Joaquin River at Jersey Point compliance location.

EC is a good indicator of other water quality constituents in the Delta. Therefore, implementation of the No Project/No Action Alternative, when compared to Existing Conditions, **would not have a substantial adverse effect** on the other water quality constituents in the Delta.

Modeling results for long-term average monthly X2 position indicate that implementation of the No Project/No Action Alternative, when compared to Existing Conditions, would result in an eastward movement of X2 by up to 0.2 kilometer (km) in April through June, and either no change or a westward movement of up to 0.1 km in July through March. Modeling results for average monthly X2 position indicate that, in Wet water years, X2 would move eastward by up to 0.2 km in all months, with the exception of March when X2 would move westward by 0.1 km. During Above Normal water years, X2 would move eastward by up to 0.3 km in April and May, and would experience either no change or move westward up to 0.2 km in June through March. During Below Normal water years, X2 would move eastward by up to 0.3 km in April and May, as well as in October through December, and would experience either no change or move westward by up to 0.5 km in the remaining months. During Dry water years, X2 would move eastward up to 0.2 km in March through May, and would experience either no change or move westward up to 0.3 km June through February. During Critical water years, X2 would move eastward in April and May by 0.2 km, and would experience either no change or move westward by up to 0.5 km.

The small eastward movements indicated during the February through June and September through November D-1641 compliance periods for the No Project/No Action Alternative, when compared to Existing Conditions, have the potential to move the X2 position out of compliance. However, a comparison of exceedance probabilities for all years indicates that the No Project/No Action Alternative would perform similarly to Existing Conditions during February through June, and would perform the same as Existing Conditions during September through November. Therefore, these slight changes in X2 position associated with implementation of the No Project/No Action Alternative, when compared to Existing Conditions, **would not have a substantial adverse effect** on X2 position compliance.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Water temperatures were not modeled or evaluated for the Delta, and there are no specific water temperature criteria in the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (SWRCB, 2006). However, water temperatures in the Delta approach equilibrium temperatures where the meteorological conditions primarily influence the water temperatures. Thus, the differences between the No Project/No Action Alternative and Existing Conditions would be minimized. Therefore, implementation of No Project/No Action Alternative, when compared to Existing Conditions, **would not have a substantial adverse effect** on water temperature in the Delta.

Suisun Bay, San Pablo Bay, San Francisco Bay

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Model simulations for Delta outflow indicate that implementation of the No Project/No Action Alternative would result in minor decreases in average monthly outflow during most months of Wet, Above Normal, and Below Normal water year types, when compared to Existing Conditions. Delta outflow would experience minor increases and decreases during Dry and Critical water years. The largest decreases are expected to occur in August of Wet water years (-5.3 percent) and October of Below Normal water years (-5.0 percent). The decrease in outflow of 5 percent during Below Normal water years could have an adverse effect on water quality in the bays. Therefore, implementation of the No Project/No Action Alternative **would have a potentially substantial adverse effect** on water quality in the bays, when compared to Existing Conditions.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Water temperatures were not modeled or evaluated for Suisun Bay, San Pablo Bay, or San Francisco Bay, and there are no specific water temperature criteria in the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (SWRCB, 2006). Based on the seasonal flow changes described above with implementation of the No Project/No Action Alternative, when compared to Existing Conditions, and because the temperatures in the Suisun Bay, San Pablo Bay, and San Francisco Bay are primarily controlled by the meteorological conditions, **there would not be a substantial adverse effect** on water temperature.

7.3.5.3 *Primary Study Area – No Project/No Action Alternative*

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

With implementation of the No Project/No Action Alternative, the proposed Project would not be constructed; additionally, none of the 14 projects included in the No Project/No Action Alternative would occur within the Primary Study Area. Therefore, surface water quality conditions in local creeks within the Primary Study Area are expected to remain similar to Existing Conditions.

Modeling results indicate that implementation of the No Project/No Action Alternative, when compared to Existing Conditions, would result in changes of up to 0.8 percent in long-term average monthly EC levels during all months at Funks Reservoir. Modeling indicates results for average monthly EC levels that would be similar during all months of all water year types, with the greatest increase of 1.2 percent occurring in November of Dry water years. No specific EC threshold exists for Funks Reservoir; these modeling results are presented to provide a base of comparison for the with-Project alternative evaluations.

Similarly, modeling results indicate that implementation of the No Project/No Action Alternative, when compared to Existing Conditions, would result in changes of up to 0.8 percent in long-term average monthly EC levels during all months at the T-C Canal intake location. Modeling indicates that results for average monthly EC levels would be similar during all months of all water year types, with the greatest increase of 1.2 percent occurring in November of Dry water years. Modeling indicates that results would be similar for long-term average and average monthly EC levels at the GCID Canal intake location, as well as at and downstream of the proposed Delevan Pipeline intake location, which is discussed for the No Project/No Action Alternative to provide a base of comparison for the with-Project alternative evaluations. The modeled average monthly EC values would not exceed the EC threshold of 230 micromhos/cm for the Sacramento River upstream of Knights Landing. Therefore, implementation of the No Project/No Action Alternative, when compared to Existing Conditions, **would not have a substantial adverse effect** on EC levels within the Primary Study Area.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Funks Reservoir water temperature was not modeled. However, because this facility would continue to act as a regulating reservoir within its historical operational range, implementation of the No Project/No Action Alternative **would not have a a substantial adverse effect** on Funks Reservoir water temperature, when compared to Existing Conditions.

Modeled Sacramento River water temperatures for the existing T-C Canal intake (Sacramento River at and downstream of Red Bluff) and GCID Canal intake (Sacramento River downstream of Hamilton City) indicate that implementation of the No Project/No Action Alternative, when compared to Existing Conditions, would result in either no change or negligible changes in average monthly temperature during all months of all water year types at these locations. Modeling indicates that results would be similar at and downstream of the location of the Delevan Pipeline Intake Facilities.

Although the specific temperature criteria of 56°F would be exceeded during several months in most water year types, the criteria is already exceeded during Existing Conditions, and implementation of the No Project/No Action Alternative would not make conditions worse. Therefore, implementation of the No Project/No Action Alternative **would not have a substantial adverse effect** on water temperatures within the Primary Study Area, when compared to Existing Conditions.

7.3.6 Impacts Associated with Alternative A

7.3.6.1 *Extended Study Area – Alternative A*

Construction, Operation, and Maintenance Impacts

Agricultural, Municipal, Industrial, and Wildlife Refuge Water Use

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Comparison of the modeled long-term average EC levels for Alternative A and Existing Conditions at Clifton Court Forebay indicates that EC levels are expected to decrease or remain similar in all months. Comparing water year type averages, EC levels for Alternative A are expected to decrease or remain similar in nearly all months of all water year types. Negligible increases of up to 2.6 percent are expected primarily in September of Wet, Above Normal, and Below Normal water years, and October of Below Normal water years. The modeled long-term average and water year type average EC levels at the Jones Pumping Plant if Alternative A is implemented are also expected to be lower or similar to Existing Conditions in all months.

Comparison of the modeled long-term average EC levels for Alternative A and the No Project/No Action Alternative at Clifton Court Forebay indicates that EC levels are expected to decrease or remain similar in all months. Negligible increases of up to 0.8 percent in the long-term average EC are expected to occur in December, April, and May. Comparing water year type averages, EC levels with implementation of Alternative A are again expected to be lower than or similar to the No Project/No Action Alternative in most months. In July and November of Above Normal water years, the average EC with Alternative A would increase by 6.5 percent and 6.1 percent, respectively. Further, negligible increases are expected in the winter, spring, and summer months of all water year types. The modeled long-term average and water year type average EC levels at the Jones Pumping Plant with implementation of Alternative A are also expected to be lower or similar to the No Project/No Action Alternative in most months. Negligible increases of up to 4.5 percent in EC levels are expected at the Jones Pumping Plant in a few months with implementation of Alternative A, when compared to the No Project/No Action Alternative.

Alternative A is expected to reduce the long-term average export-weighted EC, TDS, chloride, and bromide concentrations, when compared to Existing Conditions and the No Project/No Action Alternative. Similarly, the Dry and Critical water year average export-weighted concentrations are expected to decrease with implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative.

Although minor increases in EC levels are expected with implementation of Alternative A, the largest of all the increases are expected to occur in July and November during Above Normal water years, which have relatively wetter conditions. The resulting EC levels for Above Normal water years are expected to remain below water quality standards. Other increases in EC levels are indicated in other water year types, but the modeled EC levels are expected to remain below the Ag Goal of 700 µmhos/cm during April through August, and 1,000 µmhos/cm during September through March, which is protective of various agricultural water uses, including crop irrigation and stock watering (CVRWQCB, 2011). Consequently, EC levels are also expected to remain below the drinking water goal of 900 µmhos/cm to protect human health. Therefore, implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative, would have a **less-than-significant impact** on EC levels, TDS, bromide, and chloride concentrations associated with agricultural, municipal, industrial, and wildlife refuge water supply.

Central Valley Basin Plan EC criteria apply only to agricultural and drinking water supplies. Other water quality parameters, such as metals and nutrients, were not modeled as part of this analysis. The potential changes to the concentrations of these constituents are unknown at this time. However, the improvements in EC levels with implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative, are expected to translate into improvements in the concentrations of these constituents. Therefore, implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative, would have a **less-than-significant impact** on the concentrations of nutrients, metals, and other water quality constituents, including mercury, associated with the deliveries for agricultural, municipal, industrial, and wildlife refuge use.

San Luis Reservoir

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

With implementation of Alternative A, San Luis Reservoir would continue to experience water level fluctuations as it currently does. Modeled end-of-month long-term average surface water elevations for

Alternative A, when compared to Existing Conditions, indicate minor decreases of up to six feet in elevation in June through October. These decreases in surface water elevation fall within the historic range of operation for San Luis Reservoir. A comparison of water year type averages indicates an increase in elevation of up to seven feet during all months of Below Normal water years, and up to twelve feet during all months in Critical water years. During Dry water years, increases of up to eight feet are expected in January through June. Elevations would, therefore, be improved during periods in which algae blooms are a concern, with the exception of decreases of up to twelve feet in July through December of Dry water years.

Modeled end-of-month long-term average surface water elevations for Alternative A, when compared to the No Project/No Action Alternative, indicate minor decreases of up to three feet during June through August. These decreases in surface water elevation also fall within the historic range of operation for San Luis Reservoir. A comparison of water year type averages indicates an increase of up to eleven feet in all months of Below Normal water years. Elevations are expected to decrease up to 13 feet in all months in Dry and Critical water years.

End-of-month storage exceedance plots indicate that San Luis Reservoir would exceed 250,000 acre-feet 100 percent of the years in December through May with both Alternative A and the No Project/No Action Alternative, and that Alternative A would perform similarly to the No Project/No Action Alternative in June through November.

End-of-month storage exceedance plots indicate that San Luis Reservoir would exceed 250,000 acre-feet 100 percent of the years in December through May with both Alternative A and Existing Conditions. Alternative A would perform similarly to Existing Conditions in August through November. In June, Existing Conditions would exceed 250,000 acre-feet approximately 87 percent of the years, and Alternative A would exceed 250,000 acre-feet approximately 91 percent of the years. In July, Existing Conditions would exceed 250,000 acre-feet approximately 80 percent of the years, and Alternative A would exceed 250,000 acre-feet approximately 85 percent of the years.

Even with the expected decreases in surface water elevations associated with implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative, the end-of-month storage exceedances of 250,000 acre-feet would be similar or improved with implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative. Therefore, operational changes at San Luis Reservoir would be expected to have a less-than-significant impact on nuisance algae blooms, when compared to Existing Conditions and the No Project/No Action Alternative.

Water quality conditions in the San Luis Reservoir depend on the Delta exports from the Banks and Jones pumping plants. Refer to **Impact SW Qual-1** for the Agricultural, Municipal, Industrial, and Wildlife Refuge Water Use, which are directly applicable to San Luis Reservoir. Therefore, implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative, would have a **less-than-significant impact** on EC levels, TDS, bromide, and chloride concentrations, metals, nutrients, and other water quality constituents in the San Luis Reservoir.

7.3.6.2 *Secondary Study Area – Alternative A*

Construction, Operation, and Maintenance Impacts

Trinity Lake, Lewiston Lake, Trinity River, Klamath River downstream from Trinity River, Whiskeytown Lake, Spring Creek, Keswick Reservoir and Clear Creek

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative, would result in improved long-term average end-of-month storage conditions in Trinity Lake during all months. Average end-of-month storage by water year types is also expected to increase, with the largest increases of up to 16.1 percent expected to occur in Critical water years. Improved storage conditions would not be expected to adversely affect water quality, and would, therefore, have a **less-than-significant impact**, when compared to Existing Conditions and the No Project/No Action Alternative. Consequently, releases from Trinity Lake to the Trinity River would not be expected to adversely impact water quality, nor would flows from the Trinity River into the Klamath River. Impacts to water quality would, therefore, be **less than significant,** when compared to Existing Conditions and the No Project/No Action Alternative.

With implementation of Alternative A, Lewiston Lake and Whiskeytown Lake would continue to operate as regulating reservoirs within their historical operational range, and would not be expected to adversely impact water quality. They would, therefore, have a **less-than-significant impact,** when compared to Existing Conditions and the No Project/No Action Alternative. Consequently, Whiskeytown Lake releases to Clear Creek would not be expected to adversely impact water quality in Clear Creek, and would, therefore, be **less than significant,** when compared to Existing Conditions and the No Project/No Action Alternative.

Spring Creek and Keswick Reservoir would also continue to operate within their historical operational ranges; therefore, water quality conditions in these waters from implementation of Alternative A would result in a **less-than-significant impact**, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Modeled water temperature results indicate that implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative, would result in negligible changes to average monthly water temperature on the Trinity River at North Fork, Trinity River at Douglas City, and Trinity River downstream of Lewiston Dam locations. Consequently, flows from the Trinity River into the Klamath River would be expected to result in negligible changes or no change to Klamath River average monthly water temperatures.

Modeling results for Alternative A also indicate negligible changes to the average monthly water temperatures for the Clear Creek at Igo, Clear Creek at Mouth, and Clear Creek downstream of Whiskeytown locations, when compared to Existing Conditions and the No Project/No Action Alternative. In addition, Keswick Reservoir would continue to operate as a regulating reservoir. Consequently, flows from Clear Creek into Spring Creek would be expected to result in negligible changes or no change to Spring Creek average monthly water temperatures.

Therefore, implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative, would have a **less-than-significant impact** on water temperatures in Trinity Lake, Lewiston Lake, the Trinity River, Klamath River downstream from Trinity River, Whiskeytown Lake, Spring Creek, Keswick Reservoir, and Clear Creek.

Shasta Lake

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Modeling results indicate that implementation of Alternative A, when compared to Existing Conditions, would result in increased long-term average end-of-month storage at Shasta Lake during all months, with the exception of a negligible decrease expected during February. Modeling indicates that results for average end-of-month storage by water year type would be similar, with increased storage of up to 14.3 percent expected in all months of Critical water years. Modeling indicates that results would be similar for Alternative A, when compared to the No Project/No Action Alternative. Increased end-of-month storage would not be expected to adversely impact water quality.

Other water quality constituents of concern, including mercury and unknown toxicity, were not evaluated explicitly. However, because the Shasta Lake storage conditions are expected to improve with implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative, it is expected that the water quality would not be adversely impacted.

Therefore, implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative, would have a **less-than-significant impact** on Shasta Lake water quality.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Refer to the **Impact SW Qual-1** discussion. Improved storage conditions in Shasta Lake, with implementation of Alternative A, are expected to result in improved temperature conditions. Therefore, implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative, would have a **less-than-significant impact** on water temperatures in Shasta Lake.

Sacramento River

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

For the Keswick to Red Bluff reach of the Sacramento River, worst-case EC modeling results estimated at the T-C Canal Intake with implementation of Alternative A are expected to remain similar in most months of all water year types, when compared to Existing Conditions and the No Project/No Action Alternative. There is an expected increase of up to 0.4 percent in Wet water years to 2.7 percent in Critical water years in the April EC levels at the Red Bluff location, due to the reduction in the flow released from Shasta Lake to meet downstream requirements.

Similarly, for the Red Bluff to Hamilton City reach of the Sacramento River, worst-case EC modeling results estimated at the GCID Canal Intake are expected to decrease in most months if Alternative A is implemented, when compared to Existing Conditions and the No Project/No Action Alternative. A small increase of 0.6 percent in Wet water years to 3.4 percent in Critical water years is expected to occur in

March and April, and up to 1.4 percent in some of the fall months if Alternative A is implemented, when compared to Existing Conditions and No Project/No Action Alternative, due to the reduction in the Shasta release and the increased diversions at the T-C Canal Intake. For the Sacramento River reach between the GCID Canal Intake and the Delevan Pipeline Intake, worst-case EC modeling results indicate similar trends to the upstream reaches, when Alternative A is compared to Existing Conditions and the No Project/No Action Alternative. The worst-case EC levels with Alternative A upstream of the Delevan Pipeline Intake show minor increases in March of up to 1.8 percent and April of up to 5.6 percent, and up to 2.7 percent in some fall months. These increased EC levels would result from the reduction in Shasta releases and increased diversions at both the T-C Canal and GCID Canal intakes to fill Sites Reservoir.

Downstream of the Delevan Pipeline, worst-case EC levels in the Sacramento River are expected to increase in most months of all water year types with implementation of Alternative A when compared to Existing Conditions and the No Project/No Action Alternative. The largest of the increases are expected in April (up to 5.3 percent) and in the fall months (up to 5.9 percent). Small increases are also expected in some winter, spring, and summer months in all water year types.

The EC levels for the Sacramento River reach from the CBD to the entrance of the Delta at the I Street Bridge were not estimated explicitly. However, the changes in the EC levels in this reach are expected to trend consistently with the changes found in the upper Sacramento River reaches.

Increased EC levels with implementation of Alternative A would result from reductions in the flows released from Shasta Lake. Further, in the winter and spring months, increased diversions at the three intakes to fill Sites Reservoir would contribute to increased EC levels in the Sacramento River. In the summer and fall months, releases from Sites Reservoir would also cause EC levels to increase in the Sacramento River reach downstream of the Delevan Pipeline. Despite these increases, the water year type averages of the worst-case EC values with Alternative A, in all months, are expected to be below the Central Valley Basin Plan requirement of 230 µmhos/cm for the Sacramento River reach upstream of the CBD.

Therefore, the minor increases in the worst-case EC levels are considered negligible, and the impacts to Sacramento River EC levels due to the implementation of Alternative A would be **less than significant**, when compared to Existing Conditions and the No Project/No Action Alternative.

Other water quality constituents of concern, including mercury and unknown toxicity on the 303(d) list of impaired waters, were not evaluated explicitly. However, the changes in the concentrations of the other water quality constituents are expected to be proportional to the changes in the worst-case EC levels with Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative. Therefore, the impact on other water quality constituents in the Sacramento River due to the implementation of Alternative A would be **less than significant**, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Implementation of Alternative A would allow Shasta Dam water releases with temperatures within an acceptable range, and subsequently from Keswick Dam, to maintain mean daily water temperatures year-round at levels suitable for all species and life stages of anadromous salmonids in the Sacramento River between Keswick Dam and RBDD, with particular emphasis on the months of the highest potential water temperature-related impacts (i.e., July through October) during Below Normal, Dry, and Critical water year types.

For the Sacramento River reach between Keswick and Bend Bridge, comparison of temperature results for Alternative A with Existing Conditions and the No Project/No Action Alternative indicates similar or decreased water temperatures in summer and fall months of Below Normal, Dry, and Critical water years when the ambient temperatures are higher. In the winter and spring months (December through May) when the ambient temperatures are lower, Alternative A results indicate similar or slightly elevated water temperatures of up to 1.7 percent in all water years, and in the summer months of Wet and Above Normal water years. Modeled average monthly temperatures by water year type for Alternative A indicate that the 56°F criterion for July through October would be exceeded in this Sacramento River reach during some months of Below Normal, Dry, and/or Critical water years. Although this criterion temperature would be exceeded, it is important to note that the criterion is already exceeded with Existing Conditions and the No Project/No Action Alternative at these locations, and implementation of Alternative A would result in decreased temperatures relative to Existing Conditions and the No Project/No Action Alternative.

For the Sacramento River downstream of the GCID Canal Intake near Hamilton City, water temperatures with implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative, are expected to be similar or lower in summer and fall months of Dry and Critical water years and in fall months of Below Normal water years when the ambient temperatures are higher. Similar or slightly elevated water temperatures are expected in winter and spring months (December through May) of up to 1.7 percent in all water years, and in the summer months of Wet, Above Normal, and Below Normal water years, when the ambient temperatures are low.

For the reach upstream of the Delevan Pipeline, the changes in water temperatures would be consistent with Hamilton City. Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative, indicates similar or lower water temperatures in summer and fall months of Below Normal, Dry, and Critical water years when the ambient temperatures are higher. Similar or slightly elevated water temperatures are expected in winter and spring months (December through May) of up to 1.4 percent in all water years, and in the summer months of Wet and Above Normal water years, when the ambient temperatures are low.

Downstream of Delevan Pipeline, water temperatures in the Sacramento River may be affected by releases from Sites Reservoir. The results from preliminary temperature modeling of Sites Reservoir performed for Alternative C (Alternative C was assumed to show the worst-case conditions) indicate that in approximately 98 percent of the months, Sites Reservoir releases would be within 0.5°F of the receiving Sacramento River water temperatures. Even though the model indicates a small number of months (less than five percent) with a likely cooling impact of 0.2°F or more, the Sites Reservoir temperature results showed that it is possible to avoid such impacts by releasing from appropriate outlets. Only one month showed a cooling of more than 1°F in the 82-year simulation period. In a few years, mainly in an extended drought period when both Sites Reservoir storage and Sacramento River flow upstream of Delevan Pipeline would be low, releases from Sites Reservoir are likely to cause warming of the receiving Sacramento River waters. In less than one percent of the months, the temperatures in the Sacramento River downstream of the Delevan Pipeline are expected to increase by 1°F or more due to releases from Sites Reservoir. There are approximately five percent of the months with a likely warming impact of 0.2°F or more, although most of the months are within the same year. The warming impact is mainly found during September and October. Therefore, changes in water temperature in the Sacramento River downstream of Delevan Pipeline with implementation of Alternative A would remain consistent with the changes observed upstream of Delevan Pipeline, when compared to Existing Conditions and the No Project/No Action Alternative.

Water temperatures in the Sacramento River reach from the Feather River confluence to the I Street Bridge near the Delta approach equilibrium temperatures where the meteorological conditions primarily influence the water temperatures. Thus, the differences between Alternative A and Existing Conditions and the No Project/No Action Alternative would be minimized. Comparison of the average water temperatures for Alternative A to Existing Conditions and the No Project/No Action Alternative at the Freeport location indicates that the temperatures are expected to be similar or lower in summer and fall months of all water years. Typically, this is when the ambient temperatures are higher.

For the winter and spring months (December through May) when the ambient temperatures are low, the resulting average temperatures with implementation of Alternative A are expected to be slightly elevated by up to 0.5 percent in all water years, when compared to Existing Conditions and the No Project/No Action Alternative. Modeled average monthly temperatures by water year type for Alternative A indicate that the 68°F criterion for July through November from Hamilton City to the I Street Bridge would be exceeded at Knights Landing during some months of all water years, and at the Feather River and American River during some months of Below Normal, Dry, and Critical water years. However, it is important to note that the criterion is already exceeded with Existing Conditions and the No Project/No Action Alternative at these locations, and implementation of Alternative A would result in decreased temperatures, when compared to Existing Conditions and the No Project/No Action Alternative.

Based on the above model observations, implementation of Alternative A would result in a **less-than-significant impact**, when compared to Existing Conditions and the No Project/No Action Alternative for Sacramento River temperatures in the reach between Keswick and the I Street Bridge.

Pump Installation at the Red Bluff Pumping Plant

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Alternative A includes the installation of one pump into an existing concrete bay at the Red Bluff Pumping Plant. Operations and maintenance of this facility would include occasional dredging of the forebay to maintain design flow capacity. Pump installation and associated maintenance would occur during the annual maintenance period for the T-C Canal and would not result in sediment discharge. These activities are, therefore, expected to have a **less-than-significant impact** to EC levels and other water quality constituents in the Sacramento River, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Installation of the pump would not affect the water temperatures in the Sacramento River. Modeling results indicate that operation of this pump, as part of Alternative A, would result in similar or lower temperatures in summer and fall months of Below Normal, Dry, and Critical water years when the ambient temperatures are higher. In the winter and spring months (December through May) water temperatures would be similar or slightly elevated by up to 1.7 percent in all water years, and in the summer months of Wet and Above Normal water years, when the ambient temperatures are low. Therefore, installation of a pump at the Red Bluff Pumping Plant would have a **less-than-significant impact** on Sacramento River water temperatures, when compared to Existing Conditions and the No Project/No Action Alternative.

Lake Oroville, Thermalito Complex, and Feather River

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Modeling results indicate that implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative, would result in increased long-term average end-of-month storage at Lake Oroville in December through July, and decreased storage by up to 2.1 percent in September through November. Modeling results for average end-of-month storage indicate increases during all months of Below Normal and Critical water years, and increases in all months with the exception of minor decreases in January, February, and September in Dry water years. These overall improved storage conditions at Lake Oroville resulting from implementation of Alternative A, when compared to Existing Conditions and the No Project/no Action Alternative, would not adversely affect water quality conditions. The Thermalito Complex would continue to operate as a regulating reservoir system within its historical operational range. Consequently, releases from Lake Oroville and the Thermalito Complex would not be expected to have an adverse affect on Feather River water quality. Therefore, water quality impacts to these waters resulting from implementation of Alternative A would be **less than significant,** when compared to Existing Conditions and the No Project/No Action Alternative**.**

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Refer to the **Impact SW Qual-1** discussion. Improved storage conditions in Lake Oroville would result in similar or lower temperatures, when compared to Existing Conditions and the No Project/No Action Alternative, and would therefore have a **less-than-significant impact** on water temperature in Lake Oroville.

The Thermalito Complex would continue to operate as a regulating reservoir within the historical operational range; implementation of Alternative A would, therefore, have a **less-than-significant impact** on its water temperatures, when compared to Existing Conditions and the No Project/No Action Alternative. Modeled water temperatures for the Feather River for Alternative A indicate overall decreases, with some negligible increases in water temperatures, when compared to Existing Conditions and the No Project/No Action Alternative. Alternative A would result in similar or lower average water temperatures at the fish barrier in the low flow channel and in the high flow channel from Thermalito to the confluence of the Sacramento River in September of all water years, when compared to Existing Conditions and the No Project/No Action Alternative. In other months, there would be minor fluctuations in average water temperatures with Alternative A, with the elevated temperatures representing less than 0.8 percent in all water years. Specific Oroville Facilities temperature targets for the Feather River Fish Hatchery would be exceeded during one or more months in Below Normal, Dry, and Critical water years. Although these criteria temperatures would be exceeded, it is important to note that the criteria are already exceeded for Existing Conditions during these months, and implementation of the Alternative A would result in either the same or decreased temperatures. These slight changes in water temperatures on the Feather River resulting from implementation of Alternative A would, therefore, result in a **less-than-significant impact**, when compared to Existing Conditions and the No Project/No Action Alternative.

Sutter Bypass and Yolo Bypass

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Alternative A would be operated to divert excess Sacramento River flows from November through March to fill Sites Reservoir. During these months, this operational scenario would potentially reduce flows by up to 5,900 cfs (the total maximum diversion possible at the three intakes for Sites Reservoir) in the Sutter and Yolo bypasses. Changes in operations associated with integrated operations of Sites Reservoir with Shasta Lake may also influence the frequency and magnitude of flows in the Sutter and Yolo bypasses.

Spills into the Sutter Bypass were modeled at Ord Ferry, Moulton Weir, Colusa Weir, and Tisdale Weir. The modeling of spills was performed at a daily time-step using the USRDOM model. Monthly average exceedance probability plots indicate that spills for Alternative A would be the same or similar in frequency of spills for Existing Conditions at Ord Ferry, Moulton Weir, and Colusa Weir. Exceedance probability plots for Alternative A, when compared to the No Project/No Action Alternative would be similar in frequency of spills.

Of the four weirs, Tisdale Weir spills at the lowest flow rate, when flow in the Sacramento River exceeds approximately 23,500 cfs. Colusa Weir spills when flow in the Sacramento River exceeds approximately 30,000 cfs. Ord Ferry and Moulton Weir do not spill until flow in the Sacramento River is 70,000 cfs or higher. The changes in spills for Alternative A, when compared to Existing Conditions, vary from minor increases to decreases during high flow months when the weirs are spilling. Though the overall frequency of spills is similar, the long-term average volume of spill for Alternative A, when compared to Existing Conditions, decreases by approximately five percent at Tisdale Weir and three percent at Colusa Weir, generally in the period of December through March. Exceedance probability plots for Alternative A, when compared to the No Project/No Action Alternative, show similar decreases in the volume of spills.

Spills into the Sutter Bypass from the Sacramento River represent only some of the hydrologic inputs to the lower Sutter Bypass. Large reductions in spill flows can potentially affect the available dilution flows for various water quality constituents. The relationships and interactions of the various hydrologic inputs into the Sutter Bypass and the resulting flow and flooded area in the Sutter Bypass were not modeled. It is not anticipated that the changes in spill exceedance probabilities discussed above would have a substantial impact on surface water quality in the Sutter Bypass. Therefore, it is concluded that implementation of Alternative A would result in a **less-than-significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Spills into the Yolo Bypass at Fremont Weir and Sacramento Weir and resultant flows from the Yolo Bypass into the Sacramento-San Joaquin Delta were modeled at a daily time-step using a specialized module built into the CALSIM II model. Monthly average exceedance probability plots of Yolo Bypass flows with Alternative A, when compared to Existing Conditions, indicate lower or similar exceedance probabilities, and lower long-term average flows by approximately five percent, generally in the period of December through March. It is not anticipated that the described changes in Yolo Bypass flows and outflow would have a substantial impact on surface water quality. Therefore, water quality impacts to the Yolo Bypass resulting from implementation of Alternative A would be **less than significant**, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Water temperature modeling was not performed for the Sutter Bypass and the Yolo Bypass. However, as described above, the expected changes in spills to the Sutter Bypass represent only a portion of the input to the bypass, and flows into and out of the Yolo Bypass are expected to decrease slightly. Therefore, it is anticipated that implementation of Alternative A would have a **less-than-significant impact** on water temperature in the Sutter Bypass and Yolo Bypass, when compared to Existing Conditions and the No Project/No Action Alternative.

Folsom Lake, Lake Natoma, and American River

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Modeled long-term average end-of-month storage for Alternative A for Folsom Lake, when compared to Existing Conditions and the No Project/No Action Alternative, indicate increased storage during all months, with the exception of a negligible decrease expected to occur in June. Average end-of-month storage results indicate similar conditions in Wet, Above Normal, and Dry water years. Negligible decreases are expected in September through January and April through June of Below Normal water years, and in August through October in Critical water years. Overall improved storage conditions in Folsom Reservoir associated with implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative, would not be expected to adversely affect water quality. Lake Natoma would continue to operate as a regulating reservoir within its historical operational range. Thus, the changes in water quality in the two reservoirs would be negligible. Consequently, releases from Folsom Lake and Lake Natoma would not be expected to have a substantial adverse effect the water quality of the American River. Therefore, water quality impacts to these waters resulting from implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative, would be **less than significant.**

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Refer to the **Impact SW Qual-1** discussion. Increased Folsom Reservoir storage conditions and continued operation of Lake Natoma as a regulating reservoir system with implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative, would not result in adverse impacts to their water temperatures. Therefore, the impact to water temperature at Folsom Lake and Lake Natoma would be **less than significant.**

Modeled water temperatures for the American River downstream of Nimbus Dam, at Watt Avenue, and at the mouth for Alternative A indicate that the average monthly temperatures are expected to increase in June through November in all water years, with the exception of Critical water years, by up to 1.9 percent, when compared to Existing Conditions. These months typically have warmer water temperatures and any increase can cause an adverse effect. The indicated increases would exceed the July through September temperature target at Watt Avenue during all water years except Above Normal. However, this apparent increase in temperature is actually a result of increased American River demands and the change in operations occurring with the No Project/No Action Alternative; these adverse changes are carried forward into Alternative A, but are not associated with implementation of Alternative A.

In addition, implementation of Alternative A would result in slightly decreased temperatures in July through September during Critical water years. Therefore, the impact to American River water temperatures resulting from implementation of Alternative A is considered to be **less than significant,** when compared to Existing Conditions. When the modeled water temperatures for the American River downstream of Nimbus Dam, at Watt Avenue, and at the mouth with implementation of Alternative A are compared to the No Project/No Action Alternative, the average monthly water temperatures are found to be similar in all months during all water year types. One exception is that the average monthly temperatures with implementation of Alternative A are expected to increase in July in Above Normal water years by 0.6 percent and in Below Normal water years by 1.8 percent. The increase would not exceed the July through September temperature target at Watt Avenue during Above Normal water years, but would exceed it during Below Normal water years. To verify if the expected minor increases in temperature with implementation of Alternative A would impact compliance with the Watt Avenue temperature target, exceedance probability plots were evaluated and compared to those of the No Project/No Action Alternative. In all three months, Alternative A would perform the same as the No Project/No Action Alternative. Overall, implementation of Alternative A would result in negligible changes to American River water temperatures, and therefore, would result in a **less-than-significant impact**, when compared to the No Project/No Action Alternative.

Sacramento-San Joaquin Delta

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Modeled long-term average monthly EC results for the Sacramento River at Emmaton compliance location indicates that implementation of Alternative A, when compared to Existing Conditions, would result in similar or lower EC levels during June through January, and a slightly elevated EC levels during February through May (up to 1.3 percent). Modeled water year type average monthly EC values indicate similar trends, with increased EC during February through May, and decreased EC in other months.

The largest average EC increase is expected to occur in February in Critical water years when EC is expected to increase by 10.7 percent from approximately 459 µmhos/cm with Existing Conditions to approximately 508 µmhos/cm with Alternative A. February through May months typically have lower EC levels in the Delta because of the high natural runoff from the upstream watersheds and less salinity intrusion from the San Francisco Bay.

To verify if the minor increases in average EC levels expected in the April and May months with implementation of Alternative A would impact compliance with D-1641 salinity standards at Emmaton, exceedance probability plots of the monthly average EC values were evaluated and compared to those of Existing Conditions. The EC exceedance plots indicate that monthly average EC in April would exceed the 450 µmhos/cm Wet water year standard less than five percent of the years with Alternative A and Existing Conditions. Similarly, the monthly average EC in April with Existing Conditions and Alternative A would exceed the 630 µmhos/cm Above Normal water year standard approximately one percent of the years, and all of the years would be well under the 1,140 µmhos/cm Below Normal water year standard. During May, Alternative A and Existing Conditions would exceed 450 µmhos/cm in approximately 15 percent of the years, exceed 630 µmhos/cm in seven percent of the years, and exceed 1,140 µmhos/cm in approximately four percent of the years. In all of the years, the May monthly average EC would be less than the 1,670 µmhos/cm Dry water year standard. Therefore, in terms of compliance with D-1641 salinity standards at Emmaton, Alternative A is expected to perform, similar to Existing Conditions.

Modeled long-term average monthly EC results for the Sacramento River at Emmaton compliance location also indicate that Alternative A, when compared to the No Project/No Action Alternative, would result in similar or lower EC levels during June through December and elevated EC levels during January through May (up to 6.4 percent). Modeled water year type monthly average EC values indicate similar trends, with increased EC during January through May and decreased EC in other months. The largest increase in average EC is expected to occur in February in Critical water years, where the EC would increase by 25.8 percent from approximately 404 µmhos/cm with the No Project/No Action Alternative to approximately 508 µmhos/cm with Alternative A. January through May months typically have lower EC levels in the Delta because of the high natural runoff from the upstream watersheds and less salinity intrusion from the San Francisco Bay.

To verify if the minor increases in average EC levels expected in April and May with implementation of Alternative A would impact compliance with D-1641 salinity standards at Emmaton, exceedance probability plots of the monthly average EC values were evaluated and compared to the No Project/No Action Alternative. The EC exceedance plots indicate that the monthly average EC in April would exceed 450 µmhos/cm less than five percent of the years with Alternative A and the No Project/No Action Alternative. Similarly, the monthly average EC in April with the No Project/No Action Alternative and Alternative A would exceed 630 µmhos/cm in one percent of the years, and all of the years would be well under 1,140 µmhos/cm. For May, Alternative A and the No Project/No Action Alternative would exceed 450 µmhos/cm in approximately 15 percent of the years, exceed 630 µmhos/cm in eight percent of the years, and exceed 1,140 µmhos/cm in approximately four percent of the years. In all of the years, the May monthly average EC would be less than 1,670 µmhos/cm. Therefore, in terms of compliance with D-1641 salinity standards at Emmaton, Alternative A is expected to perform similar to the No Project/No Action Alternative.

Modeled long-term average monthly EC results for the San Joaquin River at Jersey Point compliance location indicate that Alternative A, when compared to Existing Conditions, would result in similar or lower EC levels during all months except November, when EC levels are expected to increase by 2.4 percent. Modeled water year type average monthly EC values for Alternative A indicate lower or similar EC values, when compared to Existing Conditions during January through August months, and higher EC values during September through December by up to 28.5 percent in the Wet and Above Normal water years. In Below Normal and Dry water year types, the average EC values with implementation of Alternative A would be lower or similar to Existing Conditions in all months. In the Critical water year types, the average EC with implementation of Alternative A would be lower or similar to Existing Conditions in June through August, October, December, and January, and higher in September, November, and February through May months by up to 5.5 percent.

To verify if the minor increases in average EC levels associated with implementation of Alternative A would impact compliance with D-1641 salinity standards at Jersey Point, exceedance probability plots of the monthly average EC values for Alternative A were evaluated and compared to those of Existing Conditions. The EC exceedance plots indicate that the monthly average EC in April would exceed 450 µmhos/cm less than 0.5 percent of the years with Alternative A and Existing Conditions, and all of the years would be well under 740 µmhos/cm. Similarly, the monthly average EC in May with Existing Conditions and Alternative A would exceed 450 µmhos/cm in approximately six percent of the years, would exceed 740 µmhos/cm in approximately three percent of the years, and all of the years would be well under 1,350 µmhos/cm. For June, July, and August, the number of years that Alternative A would exceed the compliance standards at Jersey Point would be similar to or lower than Existing Conditions. Therefore, in terms of compliance with D-1641 salinity standards at Jersey Point, Alternative A would perform similar to Existing Conditions.

Modeled long-term average monthly EC results for the San Joaquin River at Jersey Point compliance location with implementation of Alternative A, when compared to the No Project/No Action Alternative, indicate similar or lower EC levels during June through October and December, and higher EC levels during November, and January through May, where EC is expected to increase by up to 4.9 percent. Modeled water year type average monthly EC values for Alternative A indicate lower or similar EC values, when compared to the No Project/No Action Alternative during January through August months, and higher EC values during September through December by up to 17.6 percent in the Wet water years. In Above Normal water years, Alternative A EC levels are expected to be lower or similar in March through June months and in August and September, with increased EC levels in other months by up to 26 percent, when compared to the No Project/No Action Alternative. In Below Normal and Dry water years, the average EC values with implementation of Alternative A are expected to be lower or similar to the No Project/No Action Alternative in the most months. January, February, and March are expected to have slightly elevated EC levels of up to 3.5 percent with Alternative A, when compared to the No Project/No Action Alternative in the Below Normal water years. In Dry water years, the average EC levels with Alternative A are expected to increase by up to 2.7 percent, when compared to the No Project/No Action Alternative, in April, November, and December. In Critical water years, the average EC with Alternative A is expected to be lower or similar to the No Project/No Action Alternative in June, July, October, and December, and higher in August, September, November, and January through May by up to 10.2 percent.

To verify if the minor increases in the average EC levels expected in April and May with implementation of Alternative A would impact compliance with D-1641 standards at Jersey Point, exceedance probability plots of the monthly average EC values were evaluated and compared to the No Project/No Action Alternative. As indicated in the EC exceedance plots, the monthly average EC in April would exceed 450 µmhos/cm in approximately 0.5 percent of the years with Alternative A and the No Project/No Action Alternative, and all of the years are expected to be well under 740 µmhos/cm. For May, both Alternative A and the No Project/No Action Alternative would exceed 450 µmhos/cm in approximately five percent of the years, exceed 740 µmhos/cm in three percent of the years, and in all of the years, the May monthly average EC would be less than 1,350 µmhos/cm. For June, July, and August, the number of years that Alternative A would exceed the compliance standards at Jersey Point is similar to or lower than those of the No Project/No Action Alternative. Therefore, in terms of the compliance with D-1641 salinity standards at Jersey Point, Alternative A would perform similar to the No Project/No Action Alternative.

Implementation of Alternative A would provide supplemental Delta outflow during summer and fall months (May through December) to improve X2 position and increase estuarine habitat. Modeling results indicate that implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative, would result in eastward movement of X2 by up to 0.9 km in December through May, and a westward movement of X2 by up to 1.4 km in June through November on a long-term average basis. In Wet water years, the average X2 position with Alternative A would move eastward in October through May by up to 0.7 km, and would move up to 1.2 km westward in June through September, when compared to Existing Conditions and the No Project/No Action Alternative. In Above Normal water years, the average X2 position with Alternative A would move eastward in

November through May by up to 0.9 km, and would move up to 1.6 km westward in June through October, when compared to Existing Conditions and the No Project/No Action Alternative. In Below Normal and Dry water years, the average X2 position with Alternative A would move eastward in January through May by up to 1.7 km, and would move up to 1.9 km westward in June through December, when compared to Existing Conditions and the No Project/No Action Alternative. In Critical water years, the average X2 position with implementation of Alternative A would move eastward in February through May and November by up to two km, and would move up to 1.2 km westward in June through January, when compared to Existing Conditions and the No Project/No Action Alternative.

Even though modeling results for the average X2 position in the February through June D-1641compliance period indicate slight eastward movement, Alternative A would comply with the D-1641 spring X2 position requirements. During the September through November compliance period, the monthly average X2 position with implementation of Alternative A would be at or westward of the X2 position for Existing Conditions and the No Project/No Action Alternative.

Implementation of Alternative A would generally improve Delta salinity conditions in the summer and fall months, which are the peak salinity intrusion periods, with minor increased EC levels in the winter and spring months Alternative A complies with the X2 standards for both spring and fall. Salinity conditions at the Emmaton and Jersey Point compliance locations and X2 location are good indicators of the salinity conditions in the Delta. Therefore, implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative, would have a **less-than-significant impact** on the salinity conditions in the Delta. EC is a good indicator of other water quality constituents in the Delta. Therefore, implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative, would have a **less-than-significant impact** on the other water quality constituents in the Delta.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Water temperatures were not modeled or evaluated for the Delta, and there are no specific water temperature criteria in the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (SWRCB, 2006). However, water temperatures in the Delta approach equilibrium temperatures where the meteorological conditions primarily influence the water temperatures. Thus, the differences between Alternative A and Existing Conditions and the No Project/No Action Alternative are minimized. Therefore, implementation of Alternative A would results in a **less-than-significant impact** on water temperature in the Delta**,** when compared to Existing Conditions and the No Project/No Action Alternative.

Suisun Bay, San Pablo Bay, San Francisco Bay

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Model simulations for Delta outflow indicate that implementation of Alternative A would result in increased average monthly outflow in the summer and fall months, when conditions are relatively Dry, and small reductions in Delta outflow in the winter and spring months, when the conditions are Wet, when compared to Existing Conditions and the No Project/No Action Alternative. Therefore, these changes would result in a **less-than-significant impact** to the water quality conditions in Suisun Bay, San

Pablo Bay, and San Francisco Bay with implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Water temperatures were not modeled or evaluated for Suisun Bay, San Pablo Bay, or San Francisco Bay, and there are no specific water temperature criteria in the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (SWRCB, 2006). Based on the seasonal flow changes described above with the implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative, and because temperatures in Suisun Bay, San Pablo Bay, and San Francisco Bay are primarily controlled by the meteorological conditions, the impacts to water temperature would be **less than significant**.

7.3.6.3 *Primary Study Area – Alternative A*

Construction, Operation, and Maintenance Impacts

Impacts to surface water quality could result from the following Project construction activities:

- Soil disturbing activities such as clearing, grubbing, and earthwork that may affect drainage patterns and contribute to erosion and increased turbidity in receiving waters.
- Stockpiles of construction material that have the potential to contribute to increased deposition of sediment to receiving waters through stormwater and wind erosion.
- New unpaved construction access roads that may contribute to increased sediment deposition through wind erosion.
- Construction-related hazardous material spills.
- Temporary diversion of surface waters around construction sites.
- Dewatering of shallow groundwater.
- Disposal of concrete waste.
- Vehicle and equipment cleaning, fueling, and maintenance.
- Pile driving activities.

These activities and their potential effects on surface water quality are discussed below for the Project facilities that are proposed as part of Alternative A.

Sites Reservoir Inundation Area

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

The proposed 1.27-MAF Sites Reservoir would inundate Stone Corral, Funks, Grapevine, and Antelope creeks. It would also inundate Salt Lake. Construction activities would result in ground-disturbing activities, the temporary diversion of surface waters around construction sites, and could result in increased erosion, sediment deposition, and/or accidental hazardous or other types of materials spills.

These construction activities would have a **potentially significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Salt Lake is a 28-acre area of impounded water and seasonal wetlands located within the Sites Reservoir Inundation Area. Salt Lake is formed by warm salt springs that occur upslope. Measured EC, hardness, total dissolved solids, dissolved sodium, chloride, magnesium, and boron exceeded all applicable Central Valley Basin Plan criteria (DWR, 2012) at Salt Lake. In addition, a few metals were noted at very high concentrations (aluminum, iron, and manganese) and exceeded all criteria; and a few others exceeded some criteria (arsenic, copper, lead, and nickel). Levels of some nutrients (ammonia and orthophosphate) were noted at high levels and exceeded Central Valley Basin Plan criteria (CVRWQCB, 2011). The impact to Sites Reservoir water quality that would result from Salt Lake impoundment within the reservoir footprint would be **potentially significant.**

Refer to the **Impact SW Qual-1** discussion for the Sacramento River (Secondary Study Area discussion) for the effects of Sites Reservoir diversions and releases. Implementation of Alternative A is expected to result in a worst-case long-term average EC of 190 to 192 µmhos/cm in Sites Reservoir. The EC levels would not vary significantly among various months. Fall months show slightly lower EC levels, when compared to spring months, when Sites Reservoir is filled with water from the Sacramento River. Modeled water year type averages indicate that average worst-case EC levels would range from approximately 187 µmhos/cm in fall months of Above Normal water years to 195 µmhos/cm in spring months of Critical water years. The worst-case EC calculations include only EC from the river; they do not include EC from the inundated soils and do not consider evaporation. Based on the above model observations, releases from the reservoir into Funks and Stone Corral creeks, as well as releases into the T-C and GCID canals, would have average worst-case EC levels that fall well below the Ag Goal that is protective of agricultural water uses. Therefore, implementation of Alternative A would result in a **less-than-significant impact** in the receiving waters affected by releases from Sites Reservoir, when compared to Existing Conditions and the No Project/No Action Alternative.

Although Project impacts to EC levels as an indicator of expected general water quality conditions suggest municipal and agricultural beneficial uses would be affected at a less-than-significant level, Project effects for numerous other water quality constituents of concern are not well understood. In newly constructed reservoirs, water quality issues commonly include eutrophication (nutrient enrichment leading to nuisance algal production), sedimentation, stratification, oxygen depletion, and chemical changes in the deeper layers. The extent to which these occur depends largely upon the morphometric (i.e., size and depth) and limnological (water biology) characteristics of the reservoir, such as mixing (wind and seasonal factors), light penetration, and biological productivity, all of which are affected to some extent by the source of water, richness of the soils being flooded, and operation of the dam (URS, 2002). These water quality issues, including sedimentation, eutrophication, oxygen depletion, methylmercury levels, and chemical transformations within the water column, were not modeled, and are, therefore, considered to be **potentially significant** with implementation of Alternative A.

Maintenance activities would include debris and vegetation removal from the embankments. In addition, ongoing movement and seepage monitoring would be necessary. Impacts associated with these maintenance activities are expected to be **less than significant**, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Refer to the **Impact SW Qual-2** Secondary Study Area discussion for the Sacramento River for the effects of Sites Reservoir diversions and releases on surface water temperatures. That discussion of Sites Reservoir release temperatures is applicable to release temperatures in Funks and Stone Corral creeks, as well as to the T-C and GCID canals.

Sites Reservoir Dams

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Construction of Golden Gate Dam would result in an obstruction of flows to Funks Creek, and the construction of Sites Dam would result in an obstruction of Stone Corral Creek. Some boring would occur during grout injection of damsites during which drilling mud would be used. Drilling mud is typically a betonite (clay)-based material containing various chemical additives that may have deleterious effects if discharged into receiving waters. Some blasting may be necessary during the preparation of the dam foundations. Construction activities would result in ground-disturbing activities, the temporary diversion of surface waters around construction sites, dewatering, and could result in increased erosion, sediment deposition, and/or accidental hazardous or other types of materials spills. These construction activities would have a **potentially significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative. Once the dams are constructed and Sites Reservoir is filled, there are few dam operations required, other than the release of water from the reservoir during normal operations using the multi-level intake to optimize water quality and temperatures, or emergency operational releases. Releases could affect water quality within Sites Reservoir or downstream in receiving waters. However, these impacts are discussed for the appropriate receiving bodies of water. Typical ongoing dam maintenance would consist of equipment, foundation, and embankment inspections and repairs. Debris and vegetation removal from the embankments would be required. In addition, ongoing movement and seepage monitoring would be necessary. Water quality impacts associated with these maintenance activities would be **less than significant**, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

The saddle dams surrounding Sites Reservoir are not located near a stream, and therefore, would have **no impact** on water temperatures during construction. During construction of Sites and Golden Gate dams, the ephemeral Funks and Stone Corral creeks would be diverted. Funks Creek would be diverted away from the Golden Gate Dam construction site and routed to Stone Corral Creek; however, flows would continue to be released downstream of Funks Reservoir to maintain aquatic life. Stone Corral Creek and flows from Funks Creek would then be diverted around the Sites Dam construction site to continue downstream in the Stone Corral Creek channel. Cofferdams would be used to impound water at both sites before waters are diverted. Flow patterns would not be altered substantially from existing ephemeral conditions, and there are no downstream coldwater beneficial uses. Dam construction would, therefore, result in a **less-than-significant impact** on water temperatures, when compared to Existing Conditions and the No Project/No Action Alternative.

During operation, the saddle dams would not release water and would, therefore, have **no impact** on water temperatures. Sites and Golden Gate dams would release maintenance flows into Stone Corral and

Funks creeks, respectively. Refer to the **Impact SW Qual-2** Secondary Study Area discussion for the Sacramento River for the effects of Sites Reservoir diversions and releases on water temperatures. That discussion of Sites Reservoir release temperatures is applicable to release temperatures in Funks and Stone Corral creeks.

Typical ongoing dam maintenance would consist of equipment, foundation, and embankment inspections and repairs. Debris and vegetation removal from the embankments would be required. In addition, ongoing movement and seepage monitoring would be necessary. These maintenance activities would occur outside of the proposed reservoir, and would have a **less-than-significant impact** on water temperatures, when compared to Existing Conditions and the No Project/No Action Alternative.

Recreation Areas

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

It is anticipated that all construction activities associated with the five proposed recreation areas would occur within the footprints of the recreation areas, associated boat ramps, and the temporary and permanent access road/utility areas. Construction activities would result in ground-disturbing activities, and could result in increased erosion, sediment deposition, and/or accidental hazardous or other types of materials spills. These construction activities would, therefore, have a **potentially significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Operations of these recreational facilities would include recreation use such as hiking, camping, picnicking, and swimming. These activities could result in increased erosion, accidental hazardous or other types of materials spills, or the introduction of detergents, sewage, or solid wastes to the proposed reservoir. The provision of designated roads, trails, parking lots, campsites, beaches, day use areas, restrooms, and garbage containers would reduce the potential impacts of these activities to **less than significant**.

Recreation use would also include boating. Accidental hazardous spills from motorboats primarily occur while fueling at marina facilities. No marina or fueling facilities would be constructed at Sites Reservoir. Therefore, motorboat operation associated with recreation activities would be expected to have a **less-than-significant impact** on surface water quality.

Maintenance activities would include periodic inspection and repair of wells and water systems; vegetation trimming and management; restroom/vault toilet cleaning, stocking of supplies, pumpout, inspection, and repair; and road grading. During peak recreation use periods, these activities would likely occur on a daily basis, except for road grading, which is expected to occur once per year prior to the start of the recreation season, and repairs, which would occur when needed. During the non-peak period, the activities other than road grading would likely occur on a weekly basis and repairs would occur when needed. Water quality impacts associated with most of the described maintenance activities are, therefore, expected to be **less than significant**. However, road grading activities could result in a **potentially significant impact** due to increased erosion, sediment deposition, and/or accidental hazardous or other types of materials spills, when compared to Existing Conditions and the No Project/No Action Alternative.

Road Relocations and South Bridge

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

The construction disturbance area for the road relocations would include the footprint of the proposed roads and stream crossings, the materials and equipment staging areas, the area needed to construct the facilities, and construction access roads. Given the miles of new asphalt roads being constructed for the Project and the remote site location, an asphalt batch plant would be built on-site adjacent to the Field Office Maintenance Yard. Construction activities would result in ground-disturbing activities, the temporary diversion of surface waters around construction sites, dewatering, and could result in increased erosion, sediment deposition, and/or accidental hazardous or other types of materials spills. These construction activities would, therefore, have a **potentially significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

During Project operation, vehicles associated with recreational users, operations staff, and local traffic have the potential to leak fluids, resulting in accidental hazardous or other types of materials spills while traveling on the roads and the bridge. Potential pollutant sources from the Project roads and bridge include motor vehicles; highway surface materials, such as fine particles of asphalt and concrete; erodible shoulder materials; eroding cut and filled slopes; abrasive sand and deicing salts used in winter operations; abraded tire rubber; illegal dumping; and fluids from accidents and spills (SWRCB, 2012b). Pollutant categories include, but are not limited to, metals (such as copper, lead, and zinc); synthetic organic compounds (pesticides); Polycyclic Aromatic Hydrocarbons (PAHs) from vehicle emissions, oil, and grease; Total Petroleum Hydrocarbons (TPH); sediment; nutrients (nitrogen and phosphorus fertilizers); debris (trash and litter); pathogens; and oxygen demanding substances (decaying vegetation, animal waste, and other organic matter (SWRCB, 2012b).These pollutants are at risk of entering natural receiving waters during precipitation events and would have a **potentially significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Typical paved road maintenance would include chip sealing, patching, crack filling, asphalt overlays, embankment erosion repair, and vegetation control and maintenance. Typical culvert and minor bridge maintenance would include debris removal. Gravel road maintenance could include periodic grading. Typical bridge maintenance would include debris clearing from bridge deck and deck drainage outlets and abutment erosion maintenance and repair. Bridge maintenance could also include the periodic repair of guard rails, or the replacement of light fixtures. These maintenance activities could result in the accidental spill of hazardous materials or concrete waste, and therefore, would have a **potentially significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Sites Pumping/Generating Plant, Sites Reservoir Inlet/Outlet Structure and Tunnel from Sites Pumping/Generating Plant to Sites Reservoir Inlet/Outlet Structure

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Construction activities associated with these facilities would result in ground-disturbing activities, the temporary diversion of surface waters around construction sites, dewatering, and could result in increased erosion, sediment deposition, and/or accidental hazardous or other types of materials spills. These construction activities would, therefore, have a **potentially significant impact** on surface water quality when compared to Existing Conditions and the No Project/No Action Alternative.

These facilities would only convey water to and from Sites Reservoir; therefore, their operation would have **no impact** on surface water quality.

Routine maintenance and monitoring would likely be required on a daily basis. Regular maintenance and inspection would be done for each pump unit and the related equipment, such as gates, valves, and electrical equipment. It is possible that accidental spills of lubricants or other fluids could occur during maintenance of the pumping/generating plant. However, the plant design includes a spill containment system and a hazardous materials storage sump. Therefore, these maintenance activities would have a **less-than-significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

The pumping plant, inlet structure, and tunnel are not located near a stream, and therefore, would have **no impact** on water temperatures during construction. The footprint of the outlet structure would overlap with a portion of Funks Creek, upstream of Funks Reservoir. During construction of this facility, Funks Creek would be diverted away from the construction site, and releases would be made into Funks Creek downstream of Funks Reservoir to maintain aquatic life. Flows from Funks Creek would be diverted around the Sites Dam construction site to continue downstream in the Stone Corral Creek channel. Flow patterns would not be substantially altered from existing ephemeral conditions, and there are no downstream coldwater beneficial uses. Outlet structure construction would therefore result in a **less-than-significant impact** on water temperatures, when compared to Existing Conditions and the No Project/No Action Alternative.

During operation, these Project facilities would convey water to and from Sites Reservoir. Refer to the **Impact SW Qual-2** Secondary Study Area discussion for the Sacramento River for the effects of Sites Reservoir diversions and releases on water temperatures.

Routine maintenance, including the inspection of equipment, would not be expected to interfere with facilities operations and would, therefore, have **no impact** on water temperatures, when compared to Existing Conditions and the No Project/No Action Alternative.

Sites Electrical Switchyard, Delevan Pipeline Electrical Switchyard, and Delevan Transmission Line

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

The construction disturbance area for the Delevan Pipeline Electrical Switchyard and Delevan Transmission Line would be completely contained within the construction disturbance area of the Delevan Pipeline. The existing agricultural fields where the transmission line alignment would cross would be fallowed and not watered. Anticipated major construction activities include clearing and grading the construction workspace; placing necessary construction materials at staging areas; preparing the substation pads, and excavating and constructing tower footings. The construction disturbance area for the switchyards would include the footprint of the proposed facilities, the materials and equipment staging area, the area needed to construct the facilities, electrical transformer area, and temporary access roads. Construction activities would result in ground-disturbing activities and could result in increased erosion, sediment deposition, and/or accidental hazardous or other types of materials spills. These construction activities would have a **potentially significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Operation of the switchyards and transmission lines is an unmanned activity. Because these facilities would not store or release water, their operation would have **no impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

The transmission line would require only periodic inspection and maintenance (once or twice a year), using few vehicles and personnel. The maintenance activities would, therefore, result in **no impact** to water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Maintenance of the electrical switchyards may include annual washing and cleaning of insulating equipment, and landscape maintenance. These maintenance activities could result in ground disturbance and accidental hazardous or other types of materials spills. Therefore, the maintenance of these facilities would be a **potentially significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Field Office Maintenance Yard

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Construction of the Field Office Maintenance Yard would include transportation and placement of materials to the Project site, clearing and grading, construction of the buildings and ancillary facilities (e.g., leach field, water treatment, incinerator), and site restoration after construction is complete. Construction activities would result in ground-disturbing activities, the temporary diversion of surface waters around the Project construction site, and could result in increased erosion, sediment deposition, and/or accidental hazardous or other types of materials spills. These construction activities would have a **potentially significant** impact on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Spare parts for mechanical and electrical equipment would be stored in the warehouse along with lubricants, oils, and greases to maintain equipment. Daily operations could include personnel traveling from the Field Office Maintenance Yard to Project facilities and performing scheduled repairs and maintenance of Project equipment, observing canals and Project facilities, fueling and washing vehicles and equipment, gathering technical data on water quality and Project facilities, and as-needed repairs. Equipment repair and overhaul (e.g., pumps, turbines) may take place at this facility.

Operational activities related to the storage of hazardous materials and repair of equipment and vehicles could result in accidental spills, and could, therefore, have a **potentially significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Periodic maintenance would be performed on an as-needed basis including road, vegetation, and fence maintenance, as well as debris removal. These maintenance activities could result in increased erosion, sediment deposition, or accidental hazardous or other types of materials spills, and would, therefore, have a **potentially significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Holthouse Reservoir Complex and Holthouse Reservoir Electrical Switchyard

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

The existing Funks Reservoir would be dredged to remove accumulated sediment. Funks Creek would be diverted around the Project construction site, and Funks Reservoir would be dewatered. Installation of a T-C Canal construction bypass pipeline would also be required to divert T-C Canal flows before starting modifications to the existing Funks Reservoir or constructing the new facilities. Construction activities associated with Funks Reservoir dredging, the Holthouse Reservoir Complex, and the Holthouse Reservoir Electrical Switchyard would result in ground-disturbing activities, the temporary diversion of surface waters around the Project construction site, and dewatering, and could result in increased erosion or sediment deposition. These construction activities would have a **potentially significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Comparison between Alternative A modeled EC levels for Funks Reservoir versus Existing Conditions and the No Project/No Action Alternative indicate that these levels would increase by up to 37 percent during all months of all water year types. These increases in EC are expected to be greatest during the summer and fall months when flow is generally released from Sites Reservoir for agricultural use. The elevated EC values in November can be attributed to the initial Sites Reservoir inundation period following the previous release period when Sites Reservoir is at the lowest storage level for the year. Funks Reservoir and the Holthouse Reservoir Complex would be hydrologically connected, so EC levels for Holthouse Reservoir would be the same as described for Funks Reservoir. Despite these large increases, EC levels would fall below the Ag Goal that is protective of agricultural water uses. Implementation of Alternative A would, therefore, result in a **less-than-significant impact** on water quality (based on modeled EC conditions as an indicator of general water quality conditions), when compared to Existing Conditions and the No Project/No Action Alternative.

Other water quality issues, including sedimentation, eutrophication, oxygen depletion, methylmercury levels, and chemical transformations within the water column, were not modeled, and are, therefore, considered to be **potentially significant** with implementation of Alternative A, when compared to Existing Conditions and the No Project/No Action Alternative.

Current periodic maintenance required for the existing Funks Reservoir includes road, vegetation, and fence maintenance, as well as debris removal, on an as-needed basis. The reservoir is also drained annually. These maintenance activities are expected to continue after Funks Reservoir dredging and connection to Holthouse Reservoir. Maintenance of the electrical switchyard may include annual washing and cleaning of insulating equipment, and landscape maintenance. These maintenance activities could result in ground disturbance, the temporary diversion of surface waters around the Project construction site, accidental hazardous or other types of materials spills, and increased erosion or sediment deposition. Therefore, there would be a **potentially significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Dredging activities would require the draining of Funks Reservoir; currently (i.e., Existing Conditions), the reservoir is drained annually for maintenance. A T-C Canal bypass would be constructed prior to draining the reservoir so that canal flows would not be disrupted. Construction of Holthouse Reservoir would not affect the T-C Canal, but would affect a portion of Funks Creek immediately downstream of Funks Reservoir. However, flows would be maintained in Funks Creek downstream of Funks Reservoir to maintain aquatic life. Funks Reservoir dredging and the construction of the Holthouse Reservoir Complex would, therefore, have **no impact** on water temperatures in the T-C Canal or Funks Creek, when compared to Existing Conditions and the No Project/No Action Alternative.

The Holthouse Reservoir Complex would act as a regulating reservoir for Sites Reservoir. Refer to the **Impact SW Qual-2** Secondary Study Area discussion for the Sacramento River for the effects of Sites Reservoir diversions and releases on water temperatures.

The existing Funks Reservoir is drained annually for maintenance. T-C Canal operations accommodate this maintenance period. This maintenance activity is expected to continue after Funks Reservoir dredging and connection to Holthouse Reservoir. T-C Canal operations would be expected to continue as they do during maintenance of the existing Funks Reservoir, and flows would be maintained downstream in Funks Creek during maintenance. Therefore, maintenance activities associated with the Holthouse Reservoir Complex would have **a less-than significant impact** on water temperatures in the T-C Canal and Funks Creek, when compared to Existing Conditions and the No Project/No Action Alternative.

Glenn-Colusa Irrigation District Canal Facilities Modifications

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Construction activities associated with the new GCID Canal headgate structure, lining a portion of the canal, and replacing a railroad siphon would occur during the annual maintenance period when the canal is dry, but hazardous materials, sediment, and Portland cement wastes could be mobilized when the canal is re-watered. These activities would, therefore, be expected to have a **potentially significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Operation of the GCID Canal Intake following completion of Project construction would be similar to Existing Conditions, although an increase in wintertime operation could occur. Refer to the Secondary Study Area discussion for Sacramento River water quality impacts associated with increased diversions.

Required maintenance activities would be very similar to current maintenance. However, additional sediment removal activities may be required due to increased wintertime operation. The new headgate structure would require annual inspection and maintenance, including painting and motor control unit inspections, similar to typical check structures along the canal. Increased sediment removal activities could result in increased erosion, sediment deposition, or accidental hazardous or other types of materials spills, and would, therefore, have a **potentially significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

There would be no impact to water temperatures resulting from modification of the GCID Canal because construction would be performed while the canal is dewatered. Following completion of the modification, operation of the canal would be similar to Existing Conditions, and annual maintenance activities would continue to be performed when the canal is dry. These activities would, therefore, be expected to have **no impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Glenn-Colusa Irrigation District Canal Connection to the Terminal Regulating Reservoir, Terminal Regulating Reservoir, Terminal Regulating Reservoir Pumping/Generating Plant, Terminal Regulating Reservoir Pipeline, Terminal Regulating Reservoir Electrical Switchyard, and Terminal Regulating Reservoir Pipeline Road

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

It is anticipated that the reservoir inlet/connection from the GCID Canal to the TRR would be constructed by first building a temporary bypass channel to the west of the existing canal alignment. The temporary bypass channel would connect into the GCID Canal upstream and downstream of the construction zone to supply water to the reach of the Canal downstream of the TRR facilities area. The temporary bypass channel would be constructed using a combination of excavation, earth embankment, and sheet pile walls to isolate the Project construction site from the diversion canal. Anticipated major construction activities associated with the remaining TRR facilities include transportation of materials to the Project site, clearing and grading the construction work space, staging of construction materials, dewatering, and excavation and embankment construction. Construction activities would result in ground-disturbing activities, the temporary diversion of surface waters around Project construction sites, and could result in increased erosion or sediment deposition. These construction activities would have a **potentially significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Operational impacts to water quality for the TRR and for potential releases from the TRR to the Funks Creek Pipeline into Funks Creek are expected to be the same as described for the GCID Canal intake structure. These impacts would be **less than significant** for EC as a general water quality indicator. However, sedimentation, eutrophication, oxygen depletion, and chemical transformations within the water column have not been evaluated, and would, therefore, have a **potentially significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Maintenance activities would include removing debris that could collect upstream of check structures, maintaining gate operators to provide adequate control of gates, periodically repairing and re-painting the connection, road maintenance, and dredging the dissipation bay and inlet channel for sediment concurrently with the TRR dredging. Maintenance of the electrical switchyard may include annual washing and cleaning of insulating equipment, and landscape maintenance. Typical maintenance of the reservoir would include dredging to remove sediment when the reservoir is drained, clearing vegetation from the slopes of the embankments, and maintaining the gravel service road atop the embankment. Maintenance activities could result in ground-disturbing activities accidental hazardous or other types of materials spills, and increased erosion or sediment deposition. These maintenance activities would have a

potentially significant impact on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Prior to the start of construction of these facilities, a temporary bypass channel would be constructed to connect into the GCID Canal upstream and downstream of the construction disturbance area. During construction of these facilities, water deliveries within the canal would not be interrupted. Construction activities would, therefore, have **no impact** on water temperatures within the canal, when compared to Existing Conditions and the No Project/No Action Alternative.

For the impacts of the integrated operation of these facilities with Sites Reservoir releases on water temperatures, refer to the Alternative A Secondary Study Area **Impact SW Qual-2** discussion for the Sacramento River.

Maintenance activities that could affect the GCID Canal would be performed during the annual maintenance period of the canal, and would, therefore, have **no impact** on water temperatures within the canal, when compared to Existing Conditions and the No Project/No Action Alternative.

Delevan Pipeline

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Construction of the Delevan Pipeline would likely be performed in independent and concurrent sections. Construction of two of the sections would likely begin from the same point and move in opposite directions. As pipelines are installed and tested, the trench would be backfilled to minimize the amount of trench that is left open. Approximately 6.3 million cubic yards of material would be excavated for the pipeline trench. Excavated material would be stockpiled within the construction disturbance area and managed with standard stormwater pollution prevention practices. Trench side slopes would be approximately 1:1.5. No shoring would be installed under normal excavation conditions. Dewatering of the trench would be necessary in many locations and could be permitted to discharge into local irrigation ditches and drainage canals and/or the CBD after settling of silt. One foot of bedding material would be installed in the trench before installation of the pipeline. Bedding material would likely be sand, consolidated backfill, or cemented controlled density fill (CDF).

Excavated material would be reused to backfill the pipeline trench or would be moved to other Project locations for use, to the extent possible, after placement of the pipes. Excess spoils from the excavation (estimated at 1.3 cubic yards) would be spread on adjacent agricultural lands of willing landowners within the 800-yard-wide corridor along the pipeline alignment, used as backfill at the Sacramento River Pumping/Generating Plant, or placed in the Sites Reservoir footprint. These construction activities would result in ground-disturbing activities, the temporary diversion of surface waters around the Project construction site, dewatering, and could result in increased erosion or sediment deposition. These construction activities would have a **potentially significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

The Delevan Pipeline would convey water to and from Sites Reservoir and its associated regulating reservoirs, and therefore, the pipeline's operation would have **no impact** on surface water quality.

Periodic pipeline inspection and maintenance would likely occur once per year, typically in the months of April and May, with possible additional inspections and maintenance needed after earthquakes or storm, flood, or other emergency events. Permanent rights-of-way for the land overlying the pipeline would be maintained to guarantee future access. These routine maintenance activities are expected to have a **less-than-significant impact** to water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Because the Delevan Pipeline would convey water underground between Sites Reservoir and its associated regulating reservoirs and the Sacramento River, it is expected to have **no impact** to water temperatures.

Delevan Pipeline Intake Facilities

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

The Delevan Pipeline Intake Facilities are a system of structures designed to divert water from the Sacramento River, to safely release water from Sites Reservoir to the Sacramento River, and to generate electricity when water is released from Holthouse Reservoir through the Delevan Pipeline to the Sacramento River.

To isolate the construction area from the Sacramento River, a cellular sheet pile cofferdam would be installed in the Sacramento River near the location of the proposed fish screen. Approximately 1,200 feet of sheet piles would be required. The cofferdam would likely remain in place throughout the duration of Project facility construction. The area behind the cofferdam would be dewatered prior to construction by pumping water out from behind the cofferdam. After construction of the Project pump station is complete, the cofferdam would be removed by pulling the sheet piles out of the river and restoring the river to its previous condition. These construction activities would result in ground-disturbing activities, the temporary diversion of surface waters around the Project construction site, dewatering, and could result in increased erosion or sediment deposition. These construction activities would have a **potentially significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Diversion operations would be such that a minimum of 4,000 cfs would remain in the river channel immediately downstream of the diversion point. The expected associated minimum water surface elevation at this design condition is 51 feet. The invert of the screen structure would be set at 38 feet (four feet above the invert of the river) to reduce sediment deposition in front of the screen panels.

Intake mode would occur when the diversion is pumping water from the Sacramento River to Sites Reservoir. The Intake Facility would have the largest flows and velocities during intake mode. Water would flow through the fish screen into the forebay, through the levee tubes, into the afterbay, and then would be pumped to Sites Reservoir. During this operation, the screen cleaning mechanism would be working continuously to prevent buildup on the screen panels, and the sediment removal system would operate.

Discharge mode would occur when water from Sites Reservoir would flow back through the pumping plant to generate electricity, and the water would be discharged into the afterbay, through the levee tubes, into the forebay, and then through the fish screen and into the Sacramento River. During this activity, the sediment removal system would operate.

The diversions and the discharge at the Delevan Pipeline Intake Facilities would contribute to the worst-case EC levels in the Sacramento River. Refer to the Secondary Study Area discussion for Sacramento River water quality impacts associated with these diversions and discharges.

A jetted-piping sediment removal system would be installed behind the fish screens, moving sediment that collects behind the fish screens back into the river channel, or into the forebay. Sediment that settles in the forebay would be removed, as needed, with mechanical dredging equipment to maintain optimal operational hydraulics. Depending on sediment load in the river, the forebay may need to be cleaned annually. Operation of the sediment removal system has the potential to adversely affect turbidity in the Sacramento River if excess sediment is moved back into the river channel. This impact would be **potentially significant,** when compared to Existing Conditions and the No Project/No Action Alternative.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Refer to the Alternative A **Impact SW Qual-2** Secondary Study Area discussion for the Sacramento River regarding water temperature impacts associated with diversions and releases from the Delevan Pipeline Intake Facilities.

Project Buffer

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Construction activities within the Project Buffer include the demolition and removal of existing structures, installation of fencing, and the creation of a fuelbreak. These ground-disturbing activities may cause erosion that could result in a **potentially significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Agricultural lands within the Project Buffer would be converted to annual vegetative cover to prevent wind and water erosion of soil. This conversion would minimize the potential for erosion, and would therefore, be expected to have a **less than significant impact** on surface water quality, when compared to Existing Conditions and the No Project/ No Action Alternative.

No activities are planned or expected to occur within the Project Buffer during Project operation. Operation of the buffer would, therefore, have **no impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative. Project maintenance activities would include fence repair and fuelbreak maintenance.

Fence repair, such as the replacement of a post or barbed wire, would require little to no ground disturbance, and would, therefore, have a **less-than significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Fuelbreak maintenance, which could include additional disking or grading activities that would result in ground disturbance, may cause erosion that could result in a **potentially significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

7.3.7 Impacts Associated with Alternative B

7.3.7.1 *Extended Study Area – Alternative B*

Construction, Operation, and Maintenance Impacts

Agricultural, Municipal, Industrial, and Wildlife Refuge Water Use

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Comparison of the modeled long-term average EC levels for Alternative B and Existing Conditions at Clifton Court Forebay indicates that EC levels are expected to decrease by up to 8.3 percent in all months. Comparing the water year type averages, EC levels for Alternative B would be reduced in nearly all months of all water year types. Minor increases of up to 4.3 percent are expected primarily in November and December of Above Normal water years, and October of Critical water years. The modeled long-term average and water year type average EC levels at the Jones Pumping Plant with implementation of Alternative B, when compared to Existing Conditions would be similarly reduced, with the exception of negligible increases of up to 1.9 percent in November of Above Normal water years and October of Critical water years.

Comparison of the modeled long-term average EC levels for Alternative B and the No Project/No Action Alternative at Clifton Court Forebay indicates that EC levels are expected to decrease or remain similar in all months. Negligible increases of up to 0.8 percent in the long-term average EC are expected to occur in December. Comparing the water year type averages, EC levels with implementation of Alternative B are expected to increase by up to 2.5 percent in December, March through May, and July in Wet water years. EC levels are also expected to increase by up to 5.8 percent in November through July in Above Normal water years; by up to 1.3 percent in April, May, and July of Below Normal water years; by up to 2.5 percent in December, May, and June in Dry water years; and by up to 3.4 percent in October and December of Critical water years. The modeled long-term average EC levels at the Jones Pumping Plant with implementation of Alternative B are also expected to be lower or similar to the No Project/No Action Alternative in most months, with negligible increases of up to 0.7 percent expected in December and March through June. Comparing the water year type averages, EC levels with implementation of Alternative B at the Jones Pumping Plant are expected to increase similarly to those described for Clifton Court Forebay, but would experience negligible increases in EC levels during more months in Below Normal, Dry, and Critical water years.

Similar to Alternative A, modeling results indicate that Alternative B is expected to reduce the long-term average export-weighted EC, TDS, chloride, and bromide concentrations, when compared to Existing Conditions and the No Project/No Action Alternative. Similarly, the Dry and Critical water year average export-weighted concentrations are expected to decrease with implementation of Alternative B, when compared to Existing Conditions and the No Project/No Action Alternative.

Although minor increases in EC levels are expected with implementation of Alternative B, the largest of all of the increases are expected to occur in July, November, and December during Above Normal water years, which have relatively wetter conditions. The resulting increased EC levels for Above Normal water years for these months would be highest in December (up to 517 µmhos/cm). These modeled increases in EC levels are, therefore, expected to be below the Ag Goal and drinking water goal.

During the Below Normal, Dry, and Critical water year types, the expected negligible increases would result in higher EC levels than those described for Above Normal water years. The highest EC levels resulting from an increase would occur during the time of year when the Ag Goal is 1,000 µmhos/cm (September through March), and the drinking water goal is 900 µmhos/cm. The highest EC level resulting from an increase (772 µmhos/cm) is expected to occur during December of Critical water years at the Jones Pumping Plant. These modeled increases in EC levels are, therefore, expected to be below the Ag Goal and drinking water goal.

Therefore, implementation of Alternative B, when compared to Existing Conditions and the No Project/No Action Alternative, would have a **less-than-significant impact** on EC levels, TDS, bromide, and chloride concentrations associated with agricultural, municipal, industrial, and wildlife refuge water supply.

Other water quality parameters, such as metals and nutrients, were not modeled as part of this analysis. The potential changes to the concentrations of these constituents are unknown at this time. However, the overall improvements in EC levels with implementation of Alternative B, when compared to Existing Conditions and the No Project/No Action Alternative, are expected to translate into improvements in the concentrations of these constituents. Therefore, implementation of Alternative B, when compared to Existing Conditions and the No Project/No Action Alternative, would have a **less-than-significant impact** on the concentrations of nutrients, metals, and other water quality constituents, including mercury, associated with the deliveries for agricultural, municipal, industrial, and wildlife refuge use.

San Luis Reservoir

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Similar to Alternative A, implementation of Alternative B would result in continued water level fluctuations at San Luis Reservoir and minor decreases in end-of-month long-term average surface water elevations of up to six feet in June through October, when compared to Existing Conditions. A comparison of water year type averages indicates an increase in elevation of up to nineteen feet during all months in Critical water years. During Below Normal and Dry water years, increases of up to seven feet are expected in January through August. Elevations would, therefore, be improved during periods in which algae blooms are a concern, except for during September and October in Above Normal water years and July through October in Dry water years when there would be decreases of up to 10 feet.

Similar to Alternative A, modeled end-of-month long-term average surface water elevations for Alternative B, when compared to the No Project/No Action Alternative, indicate minor decreases of up to three feet during June through August. These decreases in surface water elevation fall within the historic range of operation for San Luis Reservoir. A comparison of water year type averages indicates an increase of up to eight feet in all months of Below Normal water years. Elevations are expected to decrease up to 14 feet in April through November in Dry water years, and in May through August, October, and December in Critical water years.

End-of-month storage exceedance plots indicate that San Luis Reservoir would exceed 250,000 acre-feet 100 percent of the years in December through May with both Alternative B and Existing Conditions. In June, Existing Conditions would exceed 250,000 acre-feet approximately 87 percent of the years, and Alternative B would exceed 250,000 acre-feet approximately 92 percent of the years. In July and August, Existing Conditions would exceed 250,000 acre-feet approximately 80 percent of the years, and Alternative B would exceed 250,000 acre-feet approximately 82 percent of the years. In September, Existing Conditions would exceed 250,000 acre-feet approximately 94 percent of the years, and Alternative B would exceed 250,000 acre-feet approximately 98 percent of the years. Alternative B would perform similarly to Existing Conditions in October.

End-of-month storage exceedance plots indicate that San Luis Reservoir would exceed 250,000 acre-feet 100 percent of the years in December through May with both Alternative B and the No Project/No Action Alternative. Alternative B and the No Project/No Action Alternative would perform within a two percent difference of each other during June and September through November, and would perform similarly to each other in July and August.

Even with the expected decreases in surface water elevations associated with implementation of Alternative B, when compared to Existing Conditions and the No Project/No Action Alternative, the end-of-month storage exceedances of 250,000 acre-feet would be similar or improved with implementation of Alternative B, when compared to Existing Conditions and the No Project/No Action Alternative. Therefore, operational changes at San Luis Reservoir would be expected to have a **less-than-significant impact** on nuisance algae blooms, when compared to Existing Conditions and the No Project/No Action Alternative.

The impact findings for the Agricultural, Municipal, Industrial, and Wildlife Refuge Water Use water quality conditions are directly applicable to San Luis Reservoir. Therefore, implementation of Alternative B, when compared to Existing Conditions and the No Project/No Action Alternative, would have a **less-than-significant impact** on EC levels; TDS, bromide, and chloride concentrations; metals, nutrients, and other water quality constituents in the San Luis Reservoir.

7.3.7.2 *Secondary Study Area – Alternative B*

Construction, Operation, and Maintenance Impacts

Implementation of Alternative B, when compared to Existing Conditions and the No Project/No Action Alternative, would result in improved storage conditions similar to those described for Alternative A at Trinity Lake, Shasta Lake, Lake Oroville, and Folsom Lake. In addition, Whiskeytown Lake, Lewiston Lake, Keswick Reservoir, the Thermalito Complex, and Lake Natoma would continue to operate as regulating reservoirs within their historical operational range, as described for Alternative A. Therefore, the impact of Alternative B on surface water quality (**Impact SW Qual-1**) and water temperature (**Impact SW Qual-2**) within these reservoirs would be the same as described for Alternative A. Consequently, modeling results show that releases from these reservoirs into the Trinity River, Klamath River downstream of the Trinity River, Clear Creek, Spring Creek, the Feather River, and the American River would also have the same impacts on surface water quality (**Impact SW Qual-1**) and water temperature (**Impact SW Qual-2)** as was described for Alternative A.

Construction, operation, and maintenance activities at the Red Bluff Pumping Plant would be the same with implementation of Alternative B as was described for Alternative A, and would, therefore, have the same impacts on surface water quality (**Impact SW Qual-1**) and water temperature(**Impact SW Qual-2**).

Alternative B would include a 1.81-MAF Sites Reservoir, and would replace the Delevan Pipeline Intake Facilities with the Delevan Pipeline Discharge Facility. These changes in storage and diversion capacity would result in operational effects to downstream Project facilities that differ slightly from those described for Alternative A. Therefore, the operational impacts of Alternative B on surface water quality and water temperatures for the remaining Project facilities in the Secondary Study Area are described below.

Sacramento River

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Implementation of Alternative B would have effects on Sacramento River EC levels upstream of the Delevan Pipeline Discharge Facility location similar to those described for Alternative A, because the long-term average worst-case EC estimated at the T-C Canal Intake with implementation of Alternative B for the Sacramento River reach between Keswick and Red Bluff is expected to decrease or remain similar in all months, when compared to Existing Conditions and the No Project/No Action Alternative. In addition, the worst-case EC estimated at the GCID Canal Intake for the reach between Red Bluff and Hamilton City is expected to remain similar in most of the months with implementation of Alternative B, when compared to Existing Conditions and the No Project/No Action Alternative. The worst-case EC levels for the Sacramento River reach between the GCID Canal Intake and the Delevan Pipeline Discharge Facility location indicate similar trends as the upstream reaches, when Alternative B is compared to the Existing Conditions and No Project/No Action Alternative. However, downstream of the Delevan Pipeline Discharge Facility, worst-case EC levels in the Sacramento River associated with Alternative B would differ from Alternative A, because Alternative B includes a discharge-only facility, rather than the intake facility included with Alternative A. Similar to Alternative A, long-term average worst-case EC levels in the Sacramento River are expected to increase in all months with Alternative B, and increase in most months in all water year types, when compared to Existing Conditions and the No Project/No Action Alternative. However, the increases associated with Alternative B are not expected to be as great as those described for Alternative A, with the largest of the increases expected to occur in April (up to 4.2 percent) and to a lesser extent in fall months (up to 3.8 percent).

The EC levels for the Sacramento River reach from the CBD to the entrance of the Delta at the I Street Bridge were not estimated explicitly. However, the changes in the EC levels in this reach are expected to trend consistently with the changes found in the upper Sacramento River reaches.

The increased EC levels with Alternative B are a result of reduction in the flows released from the Shasta Reservoir. Further, in the winter and spring months, the increased diversions at the two intakes to fill the Sites Reservoir would contribute to increased EC levels in the Sacramento River. In the summer and fall months, releases from Sites Reservoir would also cause EC levels to increase in the Sacramento River reach downstream of the Delevan Pipeline Discharge Facility. However, the water year type averages for the worst-case EC levels with Alternative B, in all months, are expected to be below the Central Valley Basin Plan requirement of 230 μmhos/cm for the Sacramento River reach upstream of the CBD.

Therefore, the minor increases in the worst-case EC levels are considered negligible, and the impact to Sacramento River EC levels due to the implementation of Alternative B would be **less than significant**, when compared to Existing Conditions and the No Project/No Action Alternative.

Other water quality constituents of concern, including mercury and unknown toxicity on the 303(d) list of impaired waters, were not evaluated explicitly. However, the changes in the concentrations of the other water quality constituents are expected to be proportional to the changes in the worst-case EC levels with implementation of Alternative B from Existing Conditions and the No Project/No Action Alternative. Therefore, the impact on the water quality constituents in the Sacramento River due to the implementation of Alternative B would be **less than significant**, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Similar to Alternative A for the Sacramento River reach from Keswick to downstream of the Delevan Pipeline Discharge Facility, modeling results indicate that Alternative B, when compared to Existing Conditions and the No Project/No Action Alternative, would result in similar or decreased water temperatures in summer and fall months of Below Normal, Dry, and Critical water year types when the ambient temperatures are higher. In April, Alternative B would result in slightly elevated water temperatures of up to 1.8 percent in all water year types.

Downstream of the Delevan Pipeline Discharge Facility, results based on preliminary temperature modeling of Sites Reservoir releases performed for Alternative C (Alternative C was assumed to show the worst-case conditions) would be similar with implementation of Alternative B, as was described for Alternative A.

Modeling results for water temperatures in the Sacramento River at Knights Landing indicate that implementation of Alternative B, when compared to Existing Conditions and the No Project/No Action Alternative, would result in negligible changes in all months of all water year types, with the greatest increase of up to 0.6 percent expected in April in all water years. Similar to Alternative A, comparison of the average water temperatures for Alternative B to Existing Conditions and the No Project/No Action Alternative at the Freeport location indicates that the temperatures would be similar or lower in summer and fall months of all water years. For the winter and spring months (December through May), the resulting average temperatures with implementation Alternative B would be slightly elevated by up to 0.5 percent in all water years, when compared to Existing Conditions and the No Project/No Action Alternative.

Modeled average monthly temperatures by water year type for Alternative B indicate that the 68°F criterion for July through November from Hamilton City to the I Street Bridge would be exceeded at Knights Landing during all water year types, and at the Feather River and American River during all water years but Above Normal. However, it is important to note that the criterion is already exceeded with Existing Conditions and the No Project/No Action Alternative at these locations, and implementation of Alternative B would result in decreased temperatures.

Based on the above model observations, implementation of Alternative B would results in a **less-than-significant impact**, when compared to Existing Conditions and the No Project/No Action Alternative, for the Sacramento River temperature for the reach between Keswick and the I street bridge.

Sutter Bypass and Yolo Bypass

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

As described for Alternative A, Alternative B would be operated to divert excess Sacramento River flows from November through March to fill Sites Reservoir. However, this operational scenario for the two intakes associated with Alternative B would potentially reduce flows by up to 3,900 cfs in the Sutter and

Yolo bypasses (as compared to the maximum of 5,900 cfs with the three intakes associated with Alternative A). Changes in operations associated with integrated operations of Sites Reservoir with Shasta Lake may also influence the frequency and magnitude of flows in the Sutter and Yolo bypasses. Because of the reduced rate of diversion, it is expected that the duration of diversion of excess flows to fill Sites Reservoir would be greater for Alternative B, when compared to Alternative A.

Similar to Alternative A, monthly average exceedance probability plots indicate that spills for Alternative B would be the same or similar in frequency of spills for Existing Conditions at Ord Ferry, Moulton Weir, and Colusa Weir. Exceedance probability plots for Alternative B, when compared to the No Project/No Action Alternative, indicate a similarity in frequency of spills.

Similar to Alternative A, the changes in spills for Alternative B, when compared to Existing Conditions, would vary from minor increases to decreases during high flow months when the weirs are spilling. Although the overall frequency of spills would be similar, the long-term average volume of spill for Alternative B, when compared to Existing Conditions, would decrease by approximately 5 percent at Tisdale Weir and 3 percent at Colusa Weir. Because it is expected that the duration of diversion of excess flows to fill Sites Reservoir would be greater for Alternative B, when compared to Alternative A, the period over which reductions in spills would occur would be longer, generally in the period of December through April. Exceedance probability plots for Alternative B, when compared to the No Project/No Action Alternative, show that similar decreases in the volume of spills are expected.

Spills into the Sutter Bypass from the Sacramento River represent only some of the hydrologic inputs to the lower Sutter Bypass. Similar to Alternative A, it is anticipated that the changes in spill exceedance probabilities discussed above would not have a substantial impact on surface water quality in the Sutter Bypass. Therefore, implementation of Alternative B would result in a **less-than-significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Similar to Alternative A, monthly average exceedance probability plots of Yolo Bypass flows with implementation of Alternative B, when compared to Existing Conditions, indicate lower similar exceedance probabilities, and lower long-term average flows, by approximately 5 percent. Because it is expected that the duration of diversion of excess flows to fill Sites Reservoir would be greater for Alternative B, when compared to Alternative A, the period over which reductions in spills would occur would be longer, generally in the period of December through April. It is anticipated that the described changes in Yolo Bypass flows and outflow would not have a substantial impact on surface water quality. Therefore, water quality impacts to the Yolo Bypass resulting from implementation of Alternative B are considered to be **less than significant,** when compared to Existing Conditions and the No Project/No Action Alternative.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Water temperature modeling was not performed for the Sutter Bypass and the Yolo Bypass. However, as described above, the expected changes in spills to the Sutter Bypass represent only a portion of the input to the bypass, and flows into and out of the Yolo Bypass are expected to decrease slightly. Therefore, it is anticipated that implementation of Alternative B would have a **less-than-significant impact** on water temperature in the Sutter Bypass and Yolo Bypass, when compared to Existing Conditions and the No Project/No Action Alternative.

Sacramento-San Joaquin Delta

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Modeled long-term average monthly EC results for the Sacramento River at Emmaton compliance location indicates that implementation of Alternative B, when compared to Existing Conditions, would result in slightly elevated EC levels during March through May of up to 1.1 percent. Modeled water year type average monthly EC values indicate similar trends, with the greatest expected increase (3.7 percent) occurring in March of Below Normal water years.

During May in Critical water years, an increase of 2.8 percent is expected to occur from approximately 828 µmhos/cm with Existing Conditions to approximately 851 µmhos/cm with Alternative B.

To verify if the minor increases in average EC levels expected in April and May with implementation of Alternative B would impact compliance with D-1641 salinity standards at Emmaton, exceedance probability plots of the monthly average EC values were evaluated and compared to those of Existing Conditions. The EC exceedance plots indicate that monthly average EC in April would exceed the 450 µmhos/cm Wet water year standard less than four percent of the years with both Alternative B and Existing Conditions. Similarly, the monthly average EC in April with both Existing Conditions and Alternative B would exceed the 630 µmhos/cm Above Normal water year standard approximately one percent of the years, and all of the years would be well under the 1,140 µmhos/cm Below Normal water year standard. During May, both Alternative B and Existing Conditions would exceed 450 µmhos/cm in approximately 14 percent of the years, exceed 630 µmhos/cm in six percent of the years, and exceed 1,140 µmhos/cm in approximately four percent of the years. In all of the years, the May monthly average EC would be less than the 1,670 µmhos/cm Dry water year standard. Therefore, in terms of compliance with D-1641 salinity standards at Emmaton, Alternative B is expected to perform similar to Existing Conditions.

Modeled long-term average monthly EC results for the Sacramento River at Emmaton compliance location indicate that Alternative B, when compared to the No Project/No Action Alternative, would result in decreased EC levels during June through January and elevated EC levels during February through May (up to 3.4 percent). Modeled water year type monthly average EC values indicate similar trends. The largest increase in average EC is expected to occur in February in Critical water years, where the EC would increase by 15.8 percent from approximately 404 µmhos/cm with the No Project/No Action Alternative to approximately 467 µmhos/cm with Alternative B.

To verify if the minor increases in average EC levels expected in the April and May months with implementation of Alternative B would impact compliance with D-1641 salinity standards at Emmaton, exceedance probability plots of the monthly average EC values were evaluated and compared to the No Project/No Action Alternative. The EC exceedance plots indicate that the monthly average EC in April would exceed 450 µmhos/cm less than four percent of the years with both Alternative B and the No Project/No Action Alternative. Similarly, the monthly average EC in April with both the No Project/No Action Alternative and Alternative B would exceed 630 µmhos/cm in one percent of the years, and all of the years would be well under 1,140 µmhos/cm. For May, both Alternative B and the No Project/No Action Alternative would exceed 450 µmhos/cm in approximately 15 percent of the years, exceed 630 µmhos/cm in eight percent of the years, and exceed 1,140 µmhos/cm in approximately four percent of the years. In all of the years, the May monthly average EC would be less than 1,670 µmhos/cm.

Therefore, in terms of compliance with D-1641 salinity standards at Emmaton, Alternative B is expected to perform similar to the No Project/No Action Alternative.

Modeled long-term average monthly EC results for the San Joaquin River at Jersey Point compliance location indicate that Alternative B, when compared to Existing Conditions, would result in lower EC levels during all months except November, where EC is expected to increase by two percent. Modeled water year type average monthly EC values for Alternative B indicate lower EC values, when compared to Existing Conditions, during January through August months in all but Critical water years, and higher EC values during September through December by up to 33.2 percent in Wet and Above Normal water years. In Below Normal and Dry water years, the average EC values with implementation of Alternative B would be lower or similar to Existing Conditions in all months. In Critical water years, the average EC with implementation of Alternative B would be lower or similar to Existing Conditions in June through August, October, December, and January, and higher in September, November, and February through May months by up to 3.8 percent.

To verify if the minor increases in average EC levels associated with implementation of Alternative B would impact compliance with D-1641 salinity standards at Jersey Point, exceedance probability plots of the monthly average EC values for Alternative B were evaluated and compared to those of Existing Conditions. The EC exceedance plots indicate that the monthly average EC in April would exceed 450 µmhos/cm less than one percent of the years with both Alternative B and Existing Conditions, and all of the years would be well under 740 µmhos/cm. Similarly, the monthly average EC in May with both Existing Conditions and Alternative B would exceed 450 µmhos/cm in approximately five percent of the years, would exceed 740 µmhos/cm in approximately three percent of the years, and all of the years would be well under 1,350 µmhos/cm. For June, July, and August, the number of years that Alternative B would exceed the compliance standards at Jersey Point would be similar to or lower than Existing Conditions. Therefore, in terms of compliance with D-1641 salinity standards at Jersey Point, Alternative B would perform similar to Existing Conditions.

Modeled long-term average monthly EC results for the San Joaquin River at Jersey Point compliance location with implementation of Alternative B, when compared to the No Project/No Action Alternative, indicate similar or lower EC levels during June through October, December, and January, and higher EC levels during November and February through May, where EC is expected to increase by up to 4.2 percent. Modeled water year type average monthly EC values for Alternative B indicate similar or decreased EC values, when compared to the No Project/No Action Alternative, during most months of all water year types, with increased EC values during September through December by up to 24.1 percent in Wet years. In Above Normal years, EC levels with Alternative B are expected to be lower or similar in March through September, with increased EC levels in other months by up to 30.6 percent, when compared to the No Project/No Action Alternative. In Below Normal and Dry years, the average EC values with implementation of Alternative B are expected to be lower or similar to the No Project/No Action Alternative in the most months. February through April are expected to have slightly elevated EC levels of up to 1.9 percent with implementation of Alternative B, when compared to the No Project/No Action Alternative in Below Normal years. In Dry years, the average EC levels with Alternative B are expected to increase by up to 3.3 percent, when compared to the No Project/No Action Alternative, in April, November, and December. In Critical years, the average EC with Alternative B is expected to be lower than the No Project/No Action Alternative in June, July, October, and December and higher in the remaining months by up to 17.6 percent.

To verify if the minor increases in the average EC levels expected in April and May with implementation of Alternative B would impact compliance with D-1641 standards at Jersey Point, exceedance probability plots of the monthly average EC values were evaluated and compared to the No Project/No Action Alternative. As indicated in the EC exceedance plots, the monthly average EC in April would exceed 450 µmhos/cm in approximately 0.5 percent of the years with both Alternative B and the No Project/No Action Alternative, and all of the years are expected to be well under 740 µmhos/cm. For May, both Alternative B and the No Project/No Action Alternative would exceed 450 µmhos/cm in approximately 4 percent of the years, exceed 740 µmhos/cm in 3 percent of the years, and in all of the years, the May monthly average EC would be less than 1,350 µmhos/cm. For June, July, and August, the number of years that Alternative B would exceed the compliance standards at Jersey Point would be similar to or lower than those of the No Project/No Action Alternative. Therefore, in terms of the compliance with D-1641 salinity standards at Jersey Point, Alternative B would perform similar to the No Project/No Action Alternative.

As described for Alternative A, implementation of Alternative B would provide supplemental Delta outflow during summer and fall months (May through December) to improve X2 position and increase estuarine habitat. Similar to Alternative A, modeling results indicate that implementation of Alternative B, when compared to Existing Conditions and the No Project/No Action Alternative, would result in eastward movement of X2 by up to 0.9 km in January through May, and a westward movement of X2 by up to 1.4 km in June through November, on a long-term average basis. In Wet years, the average X2 position with implementation of Alternative B would move eastward in October through May by up to 0.5 km, and would move up to 1.2 km westward in June through September, when compared to Existing Conditions and the No Project/No Action Alternative. In Above Normal years, the average X2 position with Alternative B would move eastward in December through May by up to 0.9 km, and would move up to 1.8 km westward in June through October, when compared to Existing Conditions and the No Project/No Action Alternative. In Below Normal and Dry years, the average X2 position with Alternative B would move eastward in January through May by up to 1.7 km, and would move up to 1.8 km westward in June through December, when compared to Existing Conditions and the No Project/No Action Alternative. In Critical years, the average X2 position with Alternative B would move eastward in February through May and November by up to 0.4 km, and would move up to 1.6 km westward in June through January, when compared to Existing Conditions and the No Project/No Action Alternative.

Even though modeling results for the average X2 position in the February through June D-1641compliance period indicate slight eastward movement, Alternative B would comply with the D-1641 spring X2 position requirements. During the September through November compliance period, the monthly average X2 position with implementation of Alternative B would be at or westward of the X2 position for Existing Conditions and the No Project/No Action Alternative.

Similar to Alternative A, implementation of Alternative B would generally improve Delta salinity conditions in the summer and fall months, which are the peak salinity intrusion periods, with minor increased EC levels in the winter and spring months. Compliance with Delta salinity standards with implementation of Alternative B would be consistent with Existing Conditions and the No Project/No Action Alternative. Alternative B would comply with the X2 standards for both spring and fall. Salinity conditions at the Emmaton and Jersey Point compliance locations, and X2 location, are good indicators of the salinity conditions in the Delta. Therefore, implementation of Alternative B, when compared to Existing Conditions and the No Project/No Action Alternative, would have a **less-than-significant impact** on the salinity conditions in the Delta. EC is a good indicator of other water quality constituents in the Delta. Therefore, implementation of Alternative B, when compared to Existing Conditions and the No Project/No Action Alternative, would have a **less-than-significant impact** on the other water quality constituents in the Delta.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Water temperatures were not modeled or evaluated for the Delta, and there are no specific water temperature criteria in the *Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary* (SWRCB, 2006). However, as described for Alternative A, water temperatures in the Delta approach equilibrium temperatures where the meteorological conditions primarily influence the water temperatures. Thus, the differences between Alternative B and Existing Conditions and the No Project/No Action Alternative would be minimized. Therefore, implementation of Alternative B would results in a **less-than-significant impact** on water temperatures in the Delta, when compared to Existing Conditions and the No Project/No Action Alternative.

Suisun Bay, San Pablo Bay, and San Francisco Bay

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Similar to Alternative A, model simulations for Delta outflow indicate that implementation of Alternative B would result in increased average monthly outflow in the summer and fall months, when conditions are relatively Dry, and small reductions in Delta outflow in the winter and spring months when the conditions are Wet, when compared to Existing Conditions and the No Project/No Action Alternative. Therefore, these changes would result in a **less-than-significant impact** to the water quality conditions in Suisun Bay, San Pablo Bay, and San Francisco Bay with the implementation of Alternative B, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Water temperatures were not modeled or evaluated for Suisun Bay, San Pablo Bay, or San Francisco Bay, and there are no specific water temperature criteria in the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (SWRCB, 2006). However, based on the seasonal flow changes described above with the implementation of Alternative B, when compared to Existing Conditions and the No Project/No Action Alternative, and because temperatures in Suisun Bay, San Pablo Bay, and San Francisco Bay are primarily controlled by the meteorological conditions, the impacts to water temperature would be **less than significant**.

7.3.7.3 *Primary Study Area – Alternative B*

Construction, Operation, and Maintenance Impacts

The following Project facilities are included in both Alternatives A and B. These facilities would require the same construction methods and operation and maintenance activities regardless of alternative, and would, therefore, result in the same construction, operation, and maintenance impacts to surface water quality and water temperature:

- Recreation Areas
- Sites Pumping/Generating Plant
- Sites Electrical Switchyard

- Tunnel from Sites Pumping/Generating Plant to Sites Reservoir Inlet/Outlet Structure
- Sites Reservoir Inlet/Outlet Structure
- Field Office Maintenance Yard
- Holthouse Reservoir Electrical Switchyard
- GCID Canal Facilities Modifications
- GCID Canal Connection to the TRR
- TRR
- TRR Pumping/Generating Plant
- TRR Electrical Switchyard
- TRR Pipeline
- TRR Pipeline Road
- Delevan Pipeline
- Delevan Pipeline Electrical Switchyard

If Alternative B is implemented, the footprints or construction disturbance areas of Sites Reservoir Dams, the Road Relocations and South Bridge, the Delevan Transmission Line, and the Project Buffer would differ from Alternative A. However, these differences in the size of the facility footprint, alignment, or construction disturbance area would not change the type of construction, operation, and maintenance activities that were described for Alternative A. They would, therefore, have the same impact on surface water quality (**Impact SW Qual-1**) and water temperature (**Impact SW Qual-2**) as described for Alternative A.

Alternative B would include a 1.81-MAF Sites Reservoir. The larger size of the facility footprint would not change the type of construction and maintenance activities that were described for Alternative A, but would result in changes in operation. The Holthouse Reservoir Complex footprint would not change between alternatives, and would, therefore, require the same type of construction and maintenance activities that were described for Alternative A. However, changes in the operation of Sites Reservoir would affect operation of Holthouse Reservoir. The Delevan Pipeline Intake Facilities (that are included in Alternative A) would be replaced by the release-only Delevan Pipeline Discharge Facility in Alternative B. Potential differences in operational impacts to Sites Reservoir and Holthouse Reservoir water quality resulting from the operation of a 1.81-MAF Sites Reservoir, as well as potential differences in impacts from the construction, operation, and maintenance of the Delevan Pipeline Discharge Facility, are discussed below.

Sites Reservoir Inundation Area

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Refer to the **Impact SW Qual-1** Alternative B Secondary Study Area discussion for the Sacramento River for the effects of Sites Reservoir diversions and releases on surface water quality. Implementation of Alternative B is expected to result in a worst-case long-term average EC of 180 to 183 µmhos/cm in Sites Reservoir, which is lower than the expected long-term average associated with implementation of Alternative A. Fall months would have slightly lower EC levels, when compared to spring months, when Sites Reservoir would be filled with water from the Sacramento River. Modeled water year type averages indicate that average worst-case EC levels would range from approximately 179 µmhos/cm in fall months of Above Normal years to 186 µmhos/cm in spring months of Critical years. Based on the above model observations, releases from the reservoir into Funks and Stone Corral creeks, as well as releases into the T-C and GCID canals, would have average worst-case EC levels that fall well below the Ag Goal that is protective of agricultural water uses. Therefore, implementation of Alternative B would result in a **less-than-significant impact** in the receiving waters affected by releases from Sites Reservoir, when compared to Existing Conditions and the No Project/No Action Alternative.

Other water quality issues, including sedimentation, eutrophication, oxygen depletion, and chemical transformations within the water column were not modeled, and are, therefore, considered to be **potentially significant** with implementation of Alternative B.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Refer to the **Impact SW Qual-2** Alternative B Secondary Study Area discussion for the Sacramento River for the effects of Sites Reservoir diversions and releases on water temperature. That discussion of Sites Reservoir release temperatures is applicable to release temperatures in Funks and Stone Corral creeks, as well as to the T-C and GCID canals.

Holthouse Reservoir Complex

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Similar to Alternative A, a comparison between Alternative B modeled EC levels for Funks Reservoir with Existing Conditions and the No Project/No Action Alternative indicate that these levels would increase by up to 34.3 percent during all months of all water year types. These increases in EC are expected to be greatest during the summer and fall months when flow is generally released from Sites Reservoir for agricultural use. Funks Reservoir and the Holthouse Reservoir Complex would be hydrologically connected, so EC levels for Holthouse Reservoir would be the same as described for Funks Reservoir.

Despite these large increases, EC levels would fall below the Ag Goal that is protective of agricultural water uses. Water quality impacts, based on modeled EC conditions with implementation of Alternative B, would therefore, be **less than significant**, when compared to Existing Conditions and No Project/No Action Alternative.

Based on EC modeling results as an indicator of general water quality conditions, impacts associated with operation of this facility would be **less than significant**, when compared to Existing Conditions and No Project/No Action Alternative.

The following water quality issues have not been estimated for this analysis: sedimentation, eutrophication, oxygen depletion, and chemical transformations within the water column. These water quality issues would, therefore, have a **potentially significant impact** with implementation of Alternative B, when compared to Existing Conditions and No Project/No Action Alternative.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

These facilities would act as regulating reservoirs for Sites Reservoir. Refer to the **Impact SW Qual-2** Alternative B Secondary Study Area discussion for the Sacramento River for the effects of Sites Reservoir diversions and releases on surface water temperatures.

Delevan Pipeline Discharge Facilities

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

The Delevan Pipeline Discharge Facility would be capable of releases to only the Sacramento River. The discharge facility would not extend into the river channel as described for the Delevan Pipeline Intake Facilities, but would still require the installation of a cellular sheet pile cofferdam extending approximately eight feet into the river. The cofferdam would likely remain in place throughout the duration of facility construction. The area behind the cofferdam would be dewatered prior to construction by pumping water out from behind the cofferdam. After construction of the pump station is complete, the cofferdam would be removed by pulling the sheet piles out of the river and restoring the river to its previous condition. These construction activities would result in ground-disturbing activities, the temporary diversion of surface waters around construction sites, and could result in increased erosion or sediment deposition. These construction activities would have a **potentially significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

The discharges from this facility would contribute to the worst-case EC levels in the Sacramento River. Refer to the **Impact SW Qual-1** Alternative B Secondary Study Area discussion for Sacramento River water quality impacts associated with these discharges. The discharge-only facility would not require sediment removal, as was described for the Alternative A Delevan Pipeline Intake Facilities. Routine maintenance activities for this facility would, therefore, have a **less-than-significant impact** to water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Refer to the **Impact SW Qual-2** Alternative B Secondary Study Area discussion for Sacramento River temperature impacts associated with releases from this facility.

7.3.8 Impacts Associated with Alternative C

7.3.8.1 *Extended Study Area – Alternative C*

<u>Construction, Operation, and Maintenance Impacts</u>

Agricultural, Municipal, Industrial, and Wildlife Refuge Water Use

Comparison of the modeled long-term average EC levels for Alternative C and Existing Conditions at Clifton Court Forebay indicates that EC levels are expected to decrease by up to 10.1 percent in all months. Comparing the water year type averages, EC levels for Alternative C would be reduced in nearly all months of all water year types. Increases of up to 5.8 percent are expected in November and December of Above Normal years. The modeled long-term average and water year type average EC levels at the Jones Pumping Plant with implementation of Alternative C, when compared to Existing Conditions would be similarly reduced, with the exception of negligible increases of up to 2.5 percent in November of Above Normal years.

Comparison of the modeled long-term average EC levels for Alternative C and the No Project/No Action Alternative at Clifton Court Forebay indicates that EC levels are expected to decrease or remain similar in all months. Comparing the water year type averages, EC levels with implementation of Alternative C are expected to increase by up to 2.5 percent in December, February through May, and July in Wet years.

EC levels are also expected to increase by up to 7.3 percent in November through July in Above Normal years; by up to 0.8 percent in February, April, and May of Below Normal years; by up to 0.6 percent in April through June in Dry years; and by up to 0.6 percent in December of Critical years. The modeled long-term average EC levels at the Jones Pumping Plant with implementation of Alternative B are also expected to be lower or similar to the No Project/No Action Alternative in most months, with negligible increases of up to 0.5 percent expected in March through June. Comparing the water year type averages, EC levels with implementation of Alternative C at the Jones Pumping Plant are expected to increase similarly to those described for Clifton Court Forebay, but would experience negligible increases in EC levels during more months in Below Normal, Dry, and Critical years.

Similar to Alternatives A and B, modeling results indicate that Alternative C is expected to reduce the long-term average export-weighted EC, TDS, chloride, and bromide concentrations, when compared to Existing Conditions and the No Project/no Action Alternative. Similarly, the Dry and Critical year average export-weighted concentrations are expected to decrease with Alternative C, when compared to Existing Conditions and the No Project/No Action Alternative.

Although minor increases in EC levels are expected with implementation of Alternative C, the largest of all the increases are expected to occur in November, and December during Above Normal years, which have relatively wetter conditions. The resulting increased EC levels for Above Normal years for these months are highest in December (up to 414 µmhos/cm). These modeled increases in EC levels are, therefore, expected to be below the Ag Goal and drinking water goal.

Therefore, implementation of Alternative C, when compared to Existing Conditions and the No Project/No Action Alternative would have a **less-than-significant impact** on EC levels, TDS, bromide, and chloride concentrations associated with agricultural, municipal, industrial, and wildlife refuge water supply.

Other water quality parameters, such as metals and nutrients, were not modeled as part of this analysis. The potential changes to the concentrations of these constituents are unknown at this time. However, the overall improvements in EC levels with Alternative C, when compared to Existing Conditions and the No Project/No Action Alternative, are expected to translate into improvements in the concentrations of these constituents. Therefore, implementation of Alternative C, when compared to Existing Conditions and the No Project/No Action Alternative, would have a **less-than-significant impact** on the concentrations of nutrients, metals, and other water quality constituents, including mercury, associated with the deliveries for agricultural, municipal, industrial, and wildlife refuge use.

San Luis Reservoir

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Implementation of Alternative C would result in continued water level fluctuations at San Luis Reservoir and minor decreases in end-of-month long-term average surface water elevations of up to eight feet in May through October, when compared to Existing Conditions. A comparison of water year type averages indicates an increase in elevation of up to eight feet during all months in Below Normal and Critical years. During Dry years, increases of up to three feet are expected in January through April. Elevations would, therefore, be improved during periods in which algae blooms are a concern, with the exception of decreases of up to 14 feet during May through December in Dry years.

Modeled end-of-month long-term average surface water elevations for Alternative C, when compared to the No Project/No Action Alternative, indicate decreases of up to five feet during May through September. These decreases in surface water elevation fall within the historic range of operation for San Luis Reservoir. A comparison of water year type averages indicates an increase of up to nine feet in all months of Below Normal years. Elevations are expected to decrease up to 20 feet in all months in Dry and Critical years.

End-of-month storage exceedance plots indicate that San Luis Reservoir would exceed 250,000 acre-feet in 100 percent of the years in December through May with both Alternative C and Existing Conditions. Alternative C would perform similarly to Existing Conditions in June through August, and would perform within an approximate three percent difference in September through November.

End-of-month storage exceedance plots indicate that San Luis Reservoir would exceed 250,000 acre-feet in 100 percent of the years in December through May with both Alternative C and the No Project/No Action Alternative. Alternative C would perform similarly to the No Project/No Action Alternative in June and July. And Alternative C and the No Project/No Action Alternative would perform within an approximate three percent difference in August through November.

Even with the expected decreases in surface water elevations associated with implementation of Alternative C, when compared to Existing Conditions and the No Project/No Action Alternative, the end-of-month storage exceedances of 250,000 acre-feet would be similar or improved with Alternative C, when compared to Existing Conditions and the No Project/No Action Alternative. Therefore, operational changes at San Luis Reservoir would be expected to have a **less-than-significant impact** on nuisance algae blooms, when compared to Existing Conditions and the No Project/No Action Alternative.

The impact findings for the Agricultural, Municipal, Industrial, and Wildlife Refuge Water Use water quality conditions are directly applicable to San Luis Reservoir. Therefore, implementation of Alternative C, when compared to Existing Conditions and the No Project/No Action Alternative, would have a **less-than-significant impact** on EC levels, TDS, bromide and chloride concentrations, metals, nutrients, and other water quality constituents in the San Luis Reservoir.

7.3.8.2 *Secondary Study Area – Alternative C*

Construction, Operation, and Maintenance Impacts

Implementation of Alternative C, when compared to Existing Conditions and the No Project/No Action Alternative, would result in improved storage conditions similar to those described for Alternative A at Trinity Lake, Shasta Lake, Lake Oroville, and Folsom Lake. In addition, Whiskeytown Lake, Lewiston Lake, Keswick Reservoir, the Thermalito Complex, and Lake Natoma would continue to operate as regulating reservoirs within their historical operational range, as described for Alternative A. Therefore, the impact of Alternative C on surface water quality (**Impact SW Qual-1**) and water temperature (**Impact SW Qual-2**) within these reservoirs would be the same as described for Alternative A. Modeling results show that releases from these reservoirs into the Trinity River, Klamath River downstream of the Trinity River, Clear Creek, Spring Creek, the Feather River, and the American River would also have similar impacts on surface water quality (**Impact SW Qual-1**) and water temperature (**Impact SW Qual-2**) as described for Alternative A.

Construction, operation, and maintenance activities at the Red Bluff Pumping Plant would be the same with implementation of Alternative C as described for Alternative A, and would, therefore, have the same impacts on surface water quality (**Impact SW Qual-1**) and water temperature (**Impact SW Qual-2**) as described for Alternative A.

Alternative C would include a 1.81-MAF Sites Reservoir (as was described for Alternative B) and the Delevan Pipeline Intake Facilities (as was described for Alternative A). This combination of storage and diversion capacity would result in operational effects to downstream Project facilities that differ slightly from those described for Alternative A. Therefore, the operational impacts of Alternative C on surface water quality and water temperatures for the remaining Project facilities in the Secondary Study Area are described below.

Sacramento River

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Implementation of Alternative C would have effects on Sacramento River EC levels upstream of the Delevan Pipeline location similar to those described for Alternatives A and B because the long-term average worst-case EC estimated at the T-C Canal Intake with implementation of Alternative C for the Sacramento River reach between Keswick and Red Bluff is expected to decrease or remain similar in all months, when compared to Existing Conditions and the No Project/No Action Alternative. In addition, the worst-case EC estimated at the GCID Canal Intake for the reach between Red Bluff and Hamilton City is expected to remain similar in most of the months with Alternative C, when compared to Existing Conditions and the No Project/No Action Alternative. The worst-case EC levels for the Sacramento River reach between the GCID Canal Intake and the Delevan Pipeline Intake location indicate similar trends as the upstream reaches, when comparing Alternative C to Existing Conditions and the No Project/No Action Alternative.

However, downstream of the Delevan Pipeline Intake location, worst-case EC levels in the Sacramento River would differ slightly with implementation of Alternative C, when compared to Alternatives A and B, because Alternative C includes a 1.81-MAF Sites Reservoir and three intakes. Similar to Alternative A, long-term average worst-case EC levels in the Sacramento River are expected to increase in all months with implementation of Alternative C, and increase in most months in all water year types, when compared to Existing Conditions and the No Project/No Action Alternative. However, the increases associated with Alternative C are expected to be greater than those described for the other alternatives, with the largest of the increases expected to occur in April (up to 5.4 percent) and October (up to 8.2 percent).

The EC levels for the Sacramento River reach from the CBD to the entrance of the Delta at the I Street Bridge were not estimated explicitly. However, the changes in the EC levels in this reach are expected to trend consistently with the changes found in the upper Sacramento River reaches.

The increased EC levels with implementation of Alternative C are a result of reduction in the flows released from the Shasta Reservoir. Further, in the winter and spring months, the increased diversions at the three intakes to fill the Sites Reservoir would contribute to increased EC levels in the Sacramento River. In the summer and fall months, releases from Sites Reservoir would also cause EC levels to increase in the Sacramento River reach downstream of the Delevan Pipeline Intake Facilities. However, the water year type averages for the worst-case EC levels with implementation of Alternative C, in all months, are expected to be below the Central Valley Basin Plan requirement of 230 µmhos/cm for the Sacramento River reach upstream of the CBD.

Therefore, the minor increases in the worst-case EC levels can be considered negligible, and the impacts to Sacramento River EC levels due to the implementation of the Alternative C would be **less than significant**, when compared to Existing Conditions and the No Project/No Action Alternative.

Other water quality constituents of concern, including mercury and unknown toxicity on the 303(d) list of impaired waters, were not evaluated explicitly. However, the changes in the concentrations of the other water quality constituents are expected to be proportional to the changes in the worst-case EC levels with implementation of Alternative C from Existing Conditions and the No Project/No Action Alternative. Therefore, the impact on the water quality constituents in the Sacramento River due to the implementation of Alternative C would be **less than significant**, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Similar to Alternative A for the Sacramento River reach from Keswick to downstream of the Delevan Pipeline Intake Facilities, modeling results indicate that Alternative C, when compared to Existing Conditions and the No Project/No Action Alternative, would result in similar or decreased water temperatures in summer and fall months of Below Normal, Dry, and Critical water year types when the ambient temperatures are higher. In April, Alternative C would result in slightly elevated water temperatures of up to 1.9 percent in all water year types.

Downstream of the Delevan Pipeline Intake Facilities, results based on preliminary temperature modeling of the Alternative C Sites Reservoir would be similar to Alternative A.

Modeling results for water temperatures in the Sacramento River at Knights Landing indicate that implementation of Alternative C, when compared to Existing Conditions and the No Project/No Action Alternative, would result in negligible changes in all months of all water year types, with the greatest increase of up to 0.6 percent expected in April in all water year types. Similar to Alternative A, comparison of the average water temperatures for Alternative C to Existing Conditions and the No Project/No Action Alternative at the Freeport location indicates that the temperatures would be similar or lower in summer and fall months of all water year types. For the winter and spring months (December through May), the resulting average temperatures with implementation of Alternative C would be slightly elevated by up to 0.6 percent in all water year types, when compared to Existing Conditions and the No Project/No Action Alternative.

Modeled average monthly temperatures by water year type for Alternative C indicate that the 68°F criterion for July through November from Hamilton City to the I Street Bridge would be exceeded at Knights Landing during all water year types, and at the Feather River and American River during all but Above Normal years. However, it is important to note that the criterion is already exceeded with Existing Conditions and the No Project/ No Action Alternative at these locations, and implementation of Alternative C would result in decreased temperatures.

Based on the above model observations, implementation of Alternative C would result in a **less-than-significant impact**, when compared to Existing Conditions and the No Project/No Action Alternative, for the Sacramento River temperature for the reach between Keswick and the I Street Bridge.

Sutter Bypass and Yolo Bypass

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

As described for Alternative A, Alternative C would be operated to divert excess Sacramento River flows from November through March to fill Sites Reservoir and would potentially reduce flows by up to 5,900 cfs in the Sutter and Yolo bypasses. Changes in operations associated with integrated operations of Sites Reservoir with Shasta Lake may also influence the frequency and magnitude of flows in the Sutter and Yolo bypasses. Because of the increased capacity of Sites Reservoir with Alternative C, when compared to Alternative A, it is expected that the frequency of diversion of excess flows to fill Sites Reservoir would be greater for Alternative C than with Alternative A.

Similar to Alternative A, monthly average exceedance probability plots indicate that spills for Alternative C would be the same or similar in frequency of spills for Existing Conditions at Ord Ferry, Moulton Weir, and Colusa Weir. Exceedance probability plots for Alternative C, when compared to the No Project/No Action Alternative, would be similar in frequency of spills.

Similar to Alternative A, the spills for Alternative C, when compared to Existing Conditions, would vary from minor increases to decreases during high flow months when the weirs are spilling. Although the overall frequency of spills would be similar to those of Existing Conditions, the long-term average volume of spill for Alternative C when compared to Existing Conditions would decrease by approximately 8 percent at Tisdale Weir and 5 percent at Colusa Weir, generally in the period of December through March. Exceedance probability plots for Alternative C, when compared to the No Project/No Action Alternative, show similar expected decreases in the volume of spills.

Spills into the Sutter Bypass from the Sacramento River represent only some of the hydrologic inputs to the lower Sutter Bypass. Similar to Alternative A, it is anticipated that the changes in spill exceedance probabilities discussed above would not have a substantial impact on surface water quality in the Sutter Bypass. Therefore, it is concluded that implementation of Alternative C would result in a **less-than-significant impact** on surface water quality, when compared to Existing Conditions and the No Project/No Action Alternative.

Similar to Alternative A, monthly average exceedance probability plots of Yolo Bypass flows with implementation of Alternative C, when compared to Existing Conditions, indicate lower similar exceedance probabilities and lower long-term average flows by approximately 7 percent, generally in the period of December through March. It is anticipated that the described changes in Yolo Bypass flows and outflow would not have a substantial impact on surface water quality. Therefore, water quality impacts to the Yolo Bypass resulting from implementation of Alternative C are considered **less than significant**, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Water temperature modeling was not performed for the Sutter Bypass and the Yolo Bypass. However, as described above, the expected changes in spills to the Sutter Bypass represent only a portion of the input to the bypass, and flows into and out of the Yolo Bypass are expected to decrease slightly. Therefore, it is anticipated that implementation of Alternative C would have a **less-than-significant impact** on water temperature in the Sutter Bypass and Yolo Bypass, when compared to Existing Conditions and the No Project/No Action Alternative.

Sacramento-San Joaquin Delta

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Modeled long-term average monthly EC results for the Sacramento River at Emmaton compliance location indicates that implementation of Alternative C, when compared to Existing Conditions, would result in slightly elevated EC levels during March through May of up to 1.2 percent. Modeled water year type average monthly EC values indicate similar trends, with the greatest expected increase (3.3 percent) occurring in March of Below Normal water years.

During May in Critical years, an increase of 3.4 percent is expected to occur from approximately 828 µmhos/cm with Existing Conditions to approximately 856 µmhos/cm with Alternative C.

To verify if the minor increases in average EC levels expected in April and May with implementation of Alternative C would impact compliance with D-1641 salinity standards at Emmaton, exceedance probability plots of the monthly average EC values were evaluated and compared to those of Existing Conditions. The EC exceedance plots indicate that monthly average EC in April would exceed the 450 µmhos/cm Wet year standard less than 4 percent of the years with both Alternative C and Existing Conditions. Similarly, the monthly average EC in April with both Existing Conditions and Alternative C would exceed the 630 µmhos/cm Above Normal water year standard approximately 1 percent of the years, and all of the years would be well under the 1,140 µmhos/cm Below Normal water year standard. During May, both Alternative C and Existing Conditions would exceed 450 µmhos/cm in approximately 14 percent of the years, exceed 630 µmhos/cm in 7 percent of the years, and exceed 1,140 µmhos/cm in approximately 4 percent of the years. In all of the years, the May monthly average EC would be less than the 1,670 µmhos/cm Dry water year standard. Therefore, in terms of compliance with D-1641 salinity standards at Emmaton, Alternative C is expected to perform similar to Existing Conditions.

Modeled long-term average monthly EC results for the Sacramento River at Emmaton compliance location indicate that Alternative C, when compared to the No Project/No Action Alternative, would result in decreased EC levels during June through December and elevated EC levels during January through May (up to 4.8 percent). Modeled water year type monthly average EC values indicate similar trends. The largest increase in average EC is expected to occur in February in Critical water years, where the EC would increase by 20.5 percent, from approximately 404 µmhos/cm with the No Project/No Action Alternative to approximately 486 µmhos/cm with Alternative C.

To verify if the minor increases in average EC levels expected in the April and May months with implementation of Alternative C would impact compliance with D-1641 salinity standards at Emmaton, exceedance probability plots of the monthly average EC values were evaluated and compared to the No Project/No Action Alternative. The EC exceedance plots indicate that the monthly average EC in April would exceed 450 µmhos/cm less than four percent of the years with both Alternative C and the No Project/No Action Alternative. Similarly, the monthly average EC in April with both Alternative C and the No Project/No Action Alternative would exceed 630 µmhos/cm in one percent of the years, and all of the years would be well under 1,140 µmhos/cm. For May, both Alternative C and the No Project/No Action Alternative would exceed 450 µmhos/cm in approximately 15 percent of the years, exceed 630 µmhos/cm in eight percent of the years, and exceed 1,140 µmhos/cm in approximately four percent of the years. In all of the years, the May monthly average EC would be less than 1,670 µmhos/cm.

Therefore, in terms of compliance with D-1,641 salinity standards at Emmaton, Alternative C is expected to perform similar to the No Project/No Action Alternative.

Modeled long-term average monthly EC results for the San Joaquin River at Jersey Point compliance location indicate that Alternative C, when compared to Existing Conditions, would result in lower EC levels during all months except March, where EC is expected to increase by 0.4 percent. Modeled water year type average monthly EC values for Alternative C indicate lower EC values, when compared to Existing Conditions, during January through August in all but Critical water years, and higher EC values during September through December by up to 36.7 percent in Wet and Above Normal water years. In Below Normal and Dry water years, the average EC values with implementation of Alternative C would be lower or similar to Existing Conditions in all months. In Critical water years, the average EC with Alternative C would be lower or similar to Existing Conditions in June through January and higher in February through May by up to 3.5 percent.

To verify if the minor increases in average EC levels associated with implementation of Alternative C would impact compliance with D-1641 salinity standards at Jersey Point, exceedance probability plots of the monthly average EC values for Alternative C were evaluated and compared to those of Existing Conditions. The EC exceedance plots indicate that the monthly average EC in April would exceed 450 µmhos/cm less than one percent of the years with both Existing Conditions and Alternative C, and all of the years would be well under 740 µmhos/cm. Similarly, the monthly average EC in May with Existing Conditions and Alternative C would exceed 450 µmhos/cm in approximately six percent of the years, would exceed 740 µmhos/cm in approximately three percent of the years, and all of the years would be well under 1,350 µmhos/cm. For June, July and August, the number of years that Alternative C would exceed the compliance standards at Jersey Point would be similar to or lower than Existing Conditions. Therefore, in terms of compliance with D-1641 salinity standards at Jersey Point, Alternative C would perform similar to Existing Conditions.

Modeled long-term average monthly EC results for the San Joaquin River at Jersey Point compliance location with implementation of Alternative C, when compared to the No Project/No Action Alternative, indicate lower EC levels during June through October and December, and higher EC levels during November and January through May, where EC is expected to increase by up to 4.8 percent. Modeled water year type average monthly EC values for Alternative C indicate similar or decreased EC values, when compared to the No Project/No Action Alternative, during most months of all water year types, with increased EC values during September through December by up to 27.7 percent in Wet water years. In Above Normal water years, Alternative C EC levels are expected to be lower or similar in February through September, with increased EC levels in other months by up to 34.1 percent, when compared to the No Project/No Action Alternative. In Below Normal and Dry water years, the average EC values with implementation of Alternative C are expected to be lower or similar to the No Project/No Action Alternative in the most months. February through April are expected to have slightly elevated EC levels of up to 1.7 percent with Alternative C, when compared to the No Project/No Action Alternative in Below Normal water years. In Critical water years, the average EC with Alternative C is expected to be lower than the No Project/No Action Alternative in June, July, October, and December and higher in the remaining months by up to 21.5 percent.

To verify if the minor increases in the average EC levels expected in April and May with implementation of Alternative C would impact compliance with D-1641 standards at Jersey Point, exceedance probability plots of the monthly average EC values were evaluated and compared to the No Project/No Action Alternative. As indicated in the EC exceedance plots, the monthly average EC in April would exceed

450 µmhos/cm in approximately 0.5 percent of the years with both Alternative C and the No Project/No Action Alternative, and all of the years are expected to be well under 740 µmhos/cm. For May, both Alternative C and the No Project/No Action Alternative would exceed 450 µmhos/cm in approximately five percent of the years, exceed 740 µmhos/cm in three percent of the years, and in all of the years, the May monthly average EC would be less than 1,350 µmhos/cm. For June, July and August, the number of years that Alternative C would exceed the compliance standards at Jersey Point would be similar to or lower than those of the No Project/No Action Alternative. Therefore, in terms of the compliance with D-1641 salinity standards at Jersey Point, Alternative C would perform similar to the No Project/No Action Alternative.

As described for Alternative A, implementation of Alternative C would provide supplemental Delta outflow during summer and fall months (May through December) to improve the X2 position and increase estuarine habitat. Similar to Alternative A, modeling results indicate that implementation of Alternative C, when compared to Existing Conditions and the No Project/No Action Alternative, would result in eastward movement of X2 by up to 0.6 km in December through May, and a westward movement of X2 by up to 1.5 km in June through November, on a long-term average basis. In Wet water years, the average X2 position with implementation of Alternative C would move eastward in October through May by up to 0.9 km, and would move up to 1.2 km westward in June through September, when compared to Existing Conditions and the No Project/No Action Alternative. In Above Normal water years, the average X2 position with Alternative C would move eastward in December through May by up to 0.9 km, and would move up to 1.8 km westward in June through October, when compared to Existing Conditions and the No Project/No Action Alternative. In Below Normal and Dry water years, the average X2 position with Alternative C would move eastward in January through May by up to 1.9 km, and would move up to 1.9 km westward in June through December, when compared to Existing Conditions and the No Project/No Action Alternative. In Critical water years, the average X2 position with Alternative C would move eastward in February through May by up to 0.8 km, and would move up to 1.4 km westward in June through January, when compared to Existing Conditions and the No Project/No Action Alternative.

Even though modeling results for the average X2 position in the February through June D-1641compliance period indicate slight eastward movement, Alternative C would comply with the D-1641 spring X2 position requirements. During the September through November compliance period, the monthly average X2 position with implementation of Alternative C would be at or westward of the X2 position for Existing Conditions and the No Project/No Action Alternative.

Similar to Alternative A, implementation of Alternative C would generally improve Delta salinity conditions in the summer and fall months, which are the peak salinity intrusion periods, with minor increased EC levels in the winter and spring months. Alternative C would comply with the X2 standards for both spring and fall. Salinity conditions at the Emmaton and Jersey Point compliance locations and the X2 location are good indicators of the salinity conditions in the Delta. Therefore, implementation of Alternative C, when compared to Existing Conditions and the No Project/No Action Alternative, would have a **less-than-significant impact** on the salinity conditions in the Delta. EC is a good indicator of other water quality constituents in the Delta. Therefore, implementation of Alternative C, when compared to Existing Conditions and the No Project/No Action Alternative, would have a **less-than-significant impact** on the other water quality constituents in the Delta.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Water temperatures were not modeled or evaluated for the Delta, and there are no specific water temperature criteria in the *Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary* (SWRCB, 2006). However, as described for Alternative A, water temperatures in the Delta approach equilibrium temperatures where the meteorological conditions primarily influence the water temperatures. Thus the differences between Alternative C and Existing Conditions and the No Project/No Action Alternative would be minimized. Therefore, implementation of Alternative C would results in a **less-than-significant impact** on water temperatures in the Delta, when compared to Existing Conditions and the No Project/No Action Alternative.

Suisun Bay, San Pablo Bay, San Francisco Bay

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Similar to Alternative A, model simulations for Delta outflow indicate that implementation of Alternative C would result in increased average monthly outflow in the summer and fall months, in relatively Dry water year conditions, and small reductions in Delta outflow in the winter and spring months, in Wet water year conditions, when compared to Existing Conditions and the No Project/No Action Alternative. Therefore, Alternative C would result in a **less-than-significant impact** to the water quality conditions in Suisun Bay, San Pablo Bay, and San Francisco Bay, when compared to Existing Conditions and the No Project/No Action Alternative.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Water temperatures were not modeled or evaluated for Suisun Bay, San Pablo Bay, or San Francisco Bay, and there are no specific water temperature criteria in the *Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary* (SWRCB, 2006). However, based on the seasonal flow changes described above with implementation of Alternative C, when compared to Existing Conditions and the No Project/No Action Alternative, and because temperatures in Suisun Bay, San Pablo Bay, and San Francisco Bay are primarily controlled by the meteorological conditions, the impacts to water temperature would be **less than significant**.

7.3.8.3 *Primary Study Area – Alternative C*

Construction, Operation, and Maintenance Impacts

The following Primary Study Area Project facilities are included in Alternatives A, B, and C. These facilities would require the same construction, operation, and maintenance activities regardless of alternative, and would, therefore, result in the same construction, operation, and maintenance impacts to surface water quality and water temperature:

- Recreation Areas
- Sites Pumping/Generating Plant
- Sites Electrical Switchyard
- Tunnel from Sites Pumping/Generating Plant to Sites Reservoir Inlet/Outlet Structure
- Sites Reservoir Inlet/Outlet Structure
- Field Office Maintenance Yard

- Holthouse Reservoir Electrical Switchyard
- GCID Canal Facilities Modifications
- GCID Canal Connection to the TRR
- TRR
- TRR Pumping/Generating Plant
- TRR Electrical Switchyard
- TRR Pipeline
- TRR Pipeline Road
- Delevan Pipeline
- Delevan Pipeline Electrical Switchyard

The Alternative C Sites Reservoir would be the same size as that described for Alternative B, and the Delevan Pipeline Intake Facilities included with Alternative C would be the same as described for Alternative A. These facilities would, therefore, require the same type of construction and maintenance activities that were described for those alternatives. However, the combination of the 1.81-MAF Sites Reservoir and the Delevan Pipeline Intake Facilities would change Project operation of Sites and Holthouse reservoirs. Therefore, although construction and maintenance impacts associated with the Holthouse Reservoir Complex would be the same as described for Alternative A, operational impacts could differ. The potential differences in impacts to water quality resulting from changes in operations in Sites Reservoir and the Holthouse Reservoir Complex are described below.

Sites Reservoir Inundation Area

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Refer to the **Impact SW Qual-1** Alternative C Secondary Study Area discussion for the Sacramento River for the effects of Sites Reservoir diversions and releases on surface water quality. Implementation of Alternative C is expected to result in a worst-case long-term average EC of 190 to 193 µmhos/cm in Sites Reservoir, which is similar to the expected long-term average associated with implementation of Alternative A, and higher than expected levels with implementation of Alternative B. Fall months show slightly lower EC levels, when compared to spring months, when Sites Reservoir is filled with water from the Sacramento River. Modeled water year type averages indicate that average worst-case EC levels would range from approximately 187 µmhos/cm in fall months of Above Normal water years to 195 µmhos/cm in spring months of Critical water years. Based on the above model observations, releases from the reservoir into Funks and Stone Corral creeks, as well as releases into the T-C and GCID canals, would have average worst-case EC levels that fall well below the Ag Goal that is protective of agricultural water uses. Therefore, implementation of Alternative C would result in a **less-than-significant impact** in the receiving waters affected by releases from Sites Reservoir, when compared to Existing Conditions and the No Project/No Action Alternative.

Other water quality issues, including sedimentation, eutrophication, oxygen depletion, and chemical transformations within the water column were not modeled, and are, therefore, considered to be **potentially significant** with implementation of Alternative C.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

Refer to the **Impact SW Qual-2** Alternative C Secondary Study Area discussion for the Sacramento River for the effects of Sites Reservoir diversions and releases on water temperature. That discussion of Sites Reservoir release temperatures is applicable to release temperatures in Funks and Stone Corral creeks, as well as to the T-C and GCID canals.

Holthouse Reservoir Complex

Impact SW Qual-1: A Violation of any Water Quality Standard or Waste Discharge Requirement, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality

Similar to Alternative A, a comparison between Alternative C modeled EC levels for Funks Reservoir and Existing Conditions and the No Project/No Action Alternative indicates that these levels would increase by up to 39.5 percent during all months of all water years. These increases in EC are expected to be greatest during the summer and fall months. Funks Reservoir and the Holthouse Reservoir Complex would be hydrologically connected, so EC levels for Holthouse Reservoir would be the same as described for Funks Reservoir. Despite these large increases, EC levels would fall below the Ag Goal that is protective of agricultural water uses. Water quality impacts based on modeled EC conditions with implementation of Alternative C would, therefore, be **less than significant**, when compared to Existing Conditions and No Project/No Action Alternative.

Additionally, the following water quality issues have not been estimated for this analysis: sedimentation, eutrophication, oxygen depletion, and chemical transformations within the water column. These water quality issues would have a **potentially significant impact** with implementation of Alternative C, when compared to Existing Conditions and No Project/No Action Alternative.

Impact SW Qual-2: A Violation of any Regulatory Temperature Criteria or Temperature Targets

These facilities would act as regulating reservoirs for Sites Reservoir. Refer to the **Impact SW Qual-2** Alternative C Secondary Study Area discussion for the Sacramento River for the effects of Sites Reservoir diversions and releases on water temperatures.

7.4 Mitigation Measures

Mitigation measures are provided below and summarized in Table 7-2 for the impacts that have been identified as significant or potentially significant.

Table 7-2
Summary of Mitigation Measures for
NODOS Project Impacts to Surface Water Quality

Impact	Associated Project Facility	LOS Before Mitigation	Mitigation Measure	LOS After Mitigation
Impact SW Qual-1: A Violation of any Water Quality Standards or Waste Discharge Requirements, a Change in Surface Water Quality Resulting in Adverse Effects to Designated Beneficial Uses of Surface Water, or Otherwise Substantially Degrade Surface Water Quality				
Impact SW Qual-1a: Reservoir sedimentation, eutrophication, oxygen depletion, and chemical transformation	Sites Reservoir, Funks Reservoir, Holthouse Reservoir, TRR	Potentially Significant	Mitigation Measure SW Qual-1a: Implement a Water Quality Monitoring, Modeling, and Operations coordination Program to Protect Beneficial Uses	Less than Significant
Impact SW Qual-1b: Contamination from inundation of Salt Lake	Sites Reservoir	Potentially Significant	Mitigation Measure SW Qual-1b: Excavate and remove or consolidate and cap Salt Lake	Less than Significant
Impact SW Qual-1c: Soil disturbing activities contributing to erosion and increased turbidity to receiving waters	All Primary Study Area Project facilities except the GCID Canal Facilities Modifications	Potentially Significant	Mitigation Measure SW Qual-1c (1): Implement soil stabilization and sediment control BMPs	Less than Significant
			Mitigation Measure SW Qual-1c (2): Prepare and Implement a Stormwater Pollution Prevention Plan	
Impact SW Qual-1d: Material stockpile management that could adversely affect surface water quality	All Primary Study Area Project Facilities except the GCID Canal Facilities Modifications	Potentially Significant	Mitigation Measure SW Qual-1c (1): Implement soil stabilization and sediment control BMPs	Less than Significant
			Mitigation Measure SW Qual-1c (2) Prepare and Implement a Stormwater Pollution Prevention Plan	
Impact SW Qual-1e: Hazardous material spills that could adversely affect surface water quality	All Primary Study Area Project Facilities except the GCID Canal Facilities Modifications	Potentially Significant	Mitigation Measure SW Qual-1e: Prepare and Implement a Stormwater Pollution Prevention Plan	Less than Significant

Table 7-2
Summary of Mitigation Measures for
NODOS Project Impacts to Surface Water Quality

Impact	Associated Project Facility	LOS Before Mitigation	Mitigation Measure	LOS After Mitigation
Impact SW Qual-1f: Temporary diversion of surface waters that could adversely affect surface water quality	All Primary Study Area Project Facilities except the GCID Canal Facilities Modifications	Potentially Significant	Mitigation Measure SW Qual-1f: Implement BMPs including diversion ditches, berms, pipelines, sheet piles, and coffer dams	Less than Significant
			Mitigation Measure SW Qual-1c (2): Prepare and Implement a Stormwater Pollution Prevention Plan	
Impact SW Qual-1g: Temporary dewatering of shallow groundwater	Sites Reservoir Dams, Road Relocations, Sites Pumping/Generating Plant, Sites Electrical Switchyard, Tunnel, Sites Reservoir Inlet/Outlet Structure, Field Office Maintenance Yard, Holthouse Reservoir Complex, TRR, TRR Pipeline, TRR Pumping/Generating Plant, TRR to Funks Creek Pipeline, GCID Connection to TRR, Delevan Pipeline, Delevan Pipeline Intake/Discharge Facilities	Potentially Significant	Mitigation Measure SW Qual-1g: Implement Caltrans Field Guide to Construction Site Dewatering	Less than Significant
			Mitigation Measure SW Qual-1c (2): Prepare and Implement a Stormwater Pollution Prevention Plan	
Impact SW Qual-1h: Concrete waste that could adversely affect surface water quality	All Primary Study Area Project facilities except the GCID Canal Facilities Modifications	Potentially Significant	Mitigation Measure SW Qual-1h: Implement concrete waste management BMPs	Less than Significant
			Mitigation Measure SW Qual-1c (2): Prepare and Implement a Stormwater Pollution Prevention Plan	
Impact SW Qual-1i: Vehicle and equipment cleaning activities that could adversely affect surface water quality	All Primary Study Area Project facilities except the GCID Canal Facilities Modifications	Potentially Significant	Mitigation Measure SW Qual-1i: Implement vehicle and equipment cleaning procedures and practices	Less than Significant
			Mitigation Measure SW Qual-1c (2): Prepare and Implement a Stormwater Pollution Prevention Plan	

Table 7-2
Summary of Mitigation Measures for
NODOS Project Impacts to Surface Water Quality

Impact	Associated Project Facility	LOS Before Mitigation	Mitigation Measure	LOS After Mitigation
Impact SW Qual-1j: Vehicle and equipment fueling activities that could adversely affect surface water quality	All Primary Study Area Project facilities except the GCID Canal Facilities Modifications	Potentially Significant	Mitigation Measure SW Qual-1j: Implement vehicle and equipment fueling procedures and practices	Less than Significant
			Mitigation Measure SW Qual-1c (2): Prepare and Implement a Stormwater Pollution Prevention Plan	
Impact SW Qual-1k: Vehicle and equipment maintenance activities that could adversely affect surface water quality	All Primary Study Area Project facilities except the GCID Canal Facilities Modifications	Potentially Significant	Mitigation Measure SW Qual-1k: Implement appropriate vehicle and equipment maintenance procedures and practices	Less than Significant
			Mitigation Measure SW Qual-1c (2): Prepare and Implement a Stormwater Pollution Prevention Plan	
Impact SW Qual-1l: Pile driving activities that could adversely affect surface water quality	Sites Reservoir and Dams, Road Relocations, Sites Pumping/Generating Plant, Sites Tunnel, Sites Reservoir Inlet/Outlet Structure, Holthouse Reservoir Complex, Terminal Regulating Reservoir, TRR Pipeline, TRR Pumping/Generating Plant, TRR to Funks Creek Pipeline, GCID Connection to TRR, Delevan Pipeline, Delevan Pipeline Intake/Discharge Facilities	Potentially Significant	Mitigation Measure SW Qual-1l: Implement appropriate pile driving procedures and practices	Less than Significant
			Mitigation Measure SW-Qual-1c (2): Prepare and Implement a Stormwater Pollution Prevention Plan	

Note:
LOS = Level of Significance

Mitigation Measure SW Qual-1a: Implement a Water Quality Monitoring, Modeling, and Operations Coordination Program to Protect Beneficial Uses

A comprehensive water monitoring program, including analysis of water quality conditions at the Project intake/discharge locations on the Sacramento River, as well as major Project conveyance and impoundment features, shall be implemented. This monitoring program shall include a network of automated real-time water monitoring locations at these locations, with data available to operators on the SCADA control system to allow real-time adaptive alteration in diversion amounts based on these conditions. This would allow operators to select the best quality waters to fill Sites Reservoir and potentially avoid importation of poor quality water that may affect the quality of Project water deliveries. This strategy could require additional modeling of Project water quality conditions to better understand the complex chemical interactions and physical and biological processes that affect contaminant levels. In addition, fish in Sites Reservoir shall be sampled and analyzed for mercury and other potential contaminants that may have deleterious effects to human and wildlife consumers. Results from these analyses shall be submitted to the Office of Environmental Health Hazard Assessment (OEHHA) for determination of the threats to consumers of fish in Sites Reservoir. Determination of adverse health effects to consumers would lead to educational postings at access points and public media to reduce exposure to contaminated fish.

Mitigation Measure SW Qual-1b: Excavate and Remove or Consolidate and Cap Salt Lake

The Salt Lake site within the footprint of Sites Reservoir for Alternatives A, B, and C would be either excavated and removed or consolidated and capped by an impermeable cover to avoid dissolution of the salt deposit into the reservoir waters. Salt Lake is fed by upslope salt springs, is many decades old, and the salt pan has accumulated to an unknown thickness over this time by evaporation. After removal/capping of the salt pan, the salt spring inputs to a completed Sites Reservoir would be diluted by high quality Sacramento River imports to a level that would be less than significant to water quality.

Mitigation Measure SW Qual-1c (1): Implement Soil Stabilization and Sediment Control BMPs

During construction activities, onsite monitoring shall be performed to identify runoff impacts. Appropriate soil stabilization BMPs; such as hydroseeding and application of other soil binders; installation of culverts, pipelines, and lined ditches to divert stormwater around disturbed soil areas; dust suppression through application of water to unpaved access roads; and placing cover material over material stockpiles; shall be implemented to reduce potentially significant construction impacts from erosion to a less-than-significant level. Sediment control BMPs, such as installation of fiber rolls and straw bales, settling/desilting basins, and other control measures, shall be implemented to reduce potentially significant construction impacts to surface water quality (suspended sediment and turbidity) and drainage to a less-than-significant level. Details of these BMPs are described in Section WM-3 of the *Construction Site Best Management Practices Manual* (Caltrans, 2003).

Mitigation Measure SW Qual-1c (2): Prepare and Implement a Stormwater Pollution Prevention Plan

The Project is subject to construction-related stormwater permit requirements of the Clean Water Act National Pollutant Discharge Elimination System (NPDES) Permit Program. DWR and Reclamation shall obtain any required permits through the CVRWQCB before any ground-disturbing construction activities occur. DWR and Reclamation shall prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) that identifies BMPs to prevent or minimize the introduction of contaminants into surface waters. BMPs for the Project could include, but are not limited to, silt fencing, straw bale barriers, diversion ditches, fiber rolls, storm drain inlet protection, hydraulic mulch, and stabilized construction entrance. The SWPPP shall include development of site-specific structural and operational BMPs to prevent and control impacts on runoff quality, measures to be implemented before each storm event, inspection and maintenance of BMPs, and monitoring of runoff quality by visual and/or analytical means.

Mitigation Measure SW Qual-1e: Prepare and Implement a Stormwater Pollution Prevention Plan

DWR and Reclamation shall prepare and implement a SWPPP that emphasizes proper hazardous materials storage and handling procedures; shall outline spill containment, cleanup, and reporting procedures; and shall limit refueling and other hazardous activities to designated upland areas. Signs prohibiting refueling shall be posted in sensitive areas. Equipment shall be inspected prior to use each day to ensure that hydraulic hoses are tight and in good condition. Other appropriate BMPs, such as use of concrete washout basins and proper waste management, combined with visual observation and water sample collection and analysis, shall be used to prevent discharge of drilling mud and other chemicals associated with construction activities and into receiving waters. Details of these BMPs are described in Section WM-4 of the *Construction Site Best Management Practices Manual* (Caltrans, 2003).

Mitigation Measure SW Qual-1f: Implement BMPs including Diversion Ditches, Berms, Pipelines, Sheet Piles, and Cofferdams

Clear water diversion consists of a system of structures and measures that intercept clear surface water runoff upstream from a Project site, transport it around the work area, and discharge it downstream from the work area with minimal water quality degradation. Clear water diversions shall be used during construction at all Primary Study Area Project Facilities except the GCID Canal Facilities Modifications, and shall be included in the SWPPP. Structures used as part of this system shall include some or all of the following: diversion ditches, berms, dikes, slope drains, pipelines, rock, gravel bags, wood, sheet piles, aqua barriers, cofferdams, filter fabric or turbidity curtains, drainage and interceptor swales, pipes, or flumes. Details of these BMPs are described in Section NS-5 of the *Construction Site Best Management Practices Manual* (Caltrans, 2003).

Mitigation Measure SW Qual-1g: Implement Caltrans Field Guide to Construction Site Dewatering

Effluent from dewatering activities shall be properly stored and disposed of to prevent contamination of surface water. This measure is intended to prevent the discharge of pollutants from construction site dewatering operations associated with stormwater (accumulated rain) and non-stormwater (e.g., groundwater or water from a diversion or cofferdam). Dewatering effluent that is discharged from a construction site to a storm drain or receiving water is subject to the requirements of the applicable NPDES Permit. Detailed guidance for management of dewatering operations is included in the *Caltrans Field Guide to Construction Site Dewatering* (Caltrans, 2001). The dewatering effluent shall be managed according to Central Valley RWQCB requirements and California Stormwater Quality Association BMPs.

Mitigation Measure SW Qual-1h: Implement Concrete Waste Management BMPs

Concrete waste management procedures and practices shall be implemented during construction of all Project facilities except the GCID Canal Facilities Modifications, where the following conditions exist: where concrete is used as a construction material or where concrete dust and debris would result from demolition activities; where slurries containing Portland cement concrete (PCC) or asphalt concrete (AC) are generated, such as from sawcutting, coring, grinding, grooving, and hydro-concrete demolition; and where concrete trucks and other concrete-coated equipment are washed on-site. Concrete waste management procedures and practices shall include some or all of the following: placing temporary berms or sandbags to contain concrete slurry wastes; constructing temporary concrete washout facilities, consisting of pits or berms with sufficient volume to contain all concrete waste from concrete truck washout procedures; regular inspection and maintenance of these BMPs; and proper disposal of hardened concrete wastes and backfill of removed concrete waste facilities after construction activities are complete. Details of these BMPs are described in Section WM-8 of the *Construction Site Best Management Practices Manual* (Caltrans, 2003).

Mitigation Measure SW Qual-1i: Implement Vehicle and Equipment Cleaning Procedures and Practices

Vehicle and equipment cleaning procedures and practices shall be used to minimize or eliminate the discharge of pollutants from vehicle and equipment cleaning operations to storm drain systems or to watercourses. On-site vehicle and equipment washing shall be discouraged. The use of solvents shall be minimized and the use of diesel for vehicle and equipment cleaning shall be prohibited. Details of these BMPs are described in Section NS-8 of the *Construction Site Best Management Practices Manual* (Caltrans, 2003).

Mitigation Measure SW Qual-1j: Implement Vehicle and Equipment Fueling Procedures and Practices

Vehicle and equipment fueling procedures and practices, including off-site fueling of all vehicles and equipment that regularly enter and leave a worksite, on-site designated fueling areas appropriately designed to prevent spilled fuel from entering storm drains or receiving waters, access to absorbent spill clean-up materials and proper disposal of used material, drip pans if equipment is fueled in an area other than designated fueling areas, and fuel nozzles equipped with automatic shut-off to control drips, shall be implemented to minimize or eliminate the discharge of fuel spills and leaks into storm drain systems or to watercourses at all Project facility sites. Fueling BMPs and spill response procedures shall also be described in the SWPPP. Details of these BMPs are described in Section NS-9 of the *Construction Site Best Management Practices Manual* (Caltrans, 2003).

Mitigation Measure SW Qual-1k: Implement Vehicle and Equipment Maintenance Procedures and Practices

Vehicle and equipment maintenance procedures and practices shall be performed to minimize or eliminate the discharge of pollutants from vehicle and equipment maintenance operations to storm drain system or to watercourses. Details of these BMPs are described in Section NS-10 of the *Construction Site Best Management Practices Manual* (Caltrans, 2003).

Mitigation Measure SW Qual-1l: Implement Pile Driving Procedures and Practices

The construction and retrofit of bridges and retaining walls often include driving piles for foundation support and shoring operations. Driven piles are typically constructed of concrete, steel, or timber. Driven sheet piles are used for shoring and cofferdam construction. Proper control and use of equipment, materials, and waste products from pile driving operations shall be implemented to reduce the discharge of potential pollutants to the storm drain system or watercourses. Details of these BMPs are described in Section NS-11 of the *Construction Site Best Management Practices Manual* (Caltrans, 2003).

Implementation of **Mitigation Measures SW Qual-1a, SW Qual-1b, SW Qual-1c (1), SW Qual-1c (2), SW Qual-1e, SW Qual-1f, SW Qual-1g, SW Qual-1h, SW Qual-1i, SW-Qual-1j, SW-Qual-1k,** and **SW Qual-1l** would reduce the level of significance of Project impacts to surface water quality to **less than significant**.

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Figure

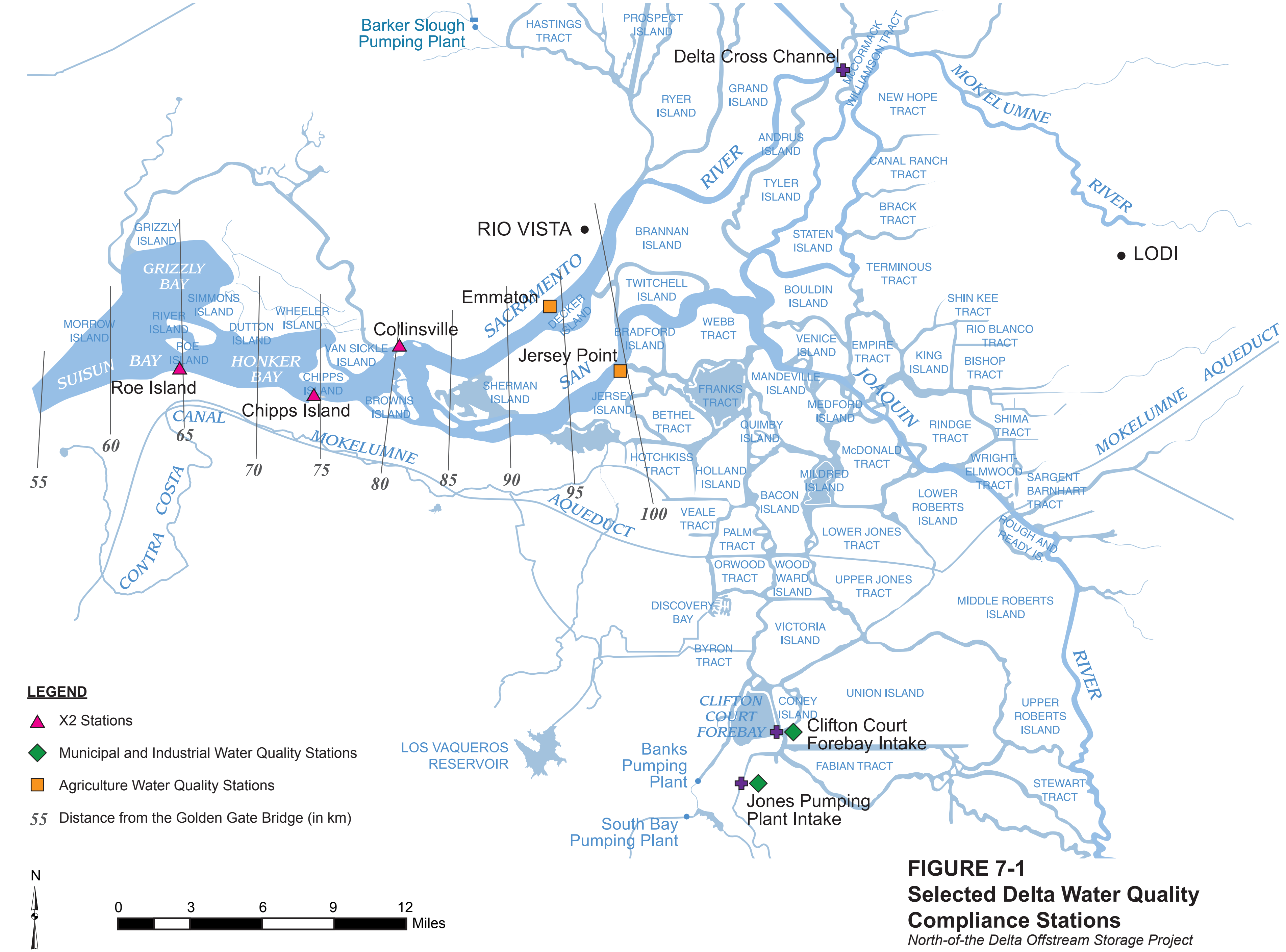

FIGURE 7-1
Selected Delta Water Quality Compliance Stations
North-of-the Delta Offstream Storage Project

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